SECTION 73

ENERGY STRATEGY 2022

DECEMBER 2022

The Energy Strategy comprises separate documents for phases 2 and 3. These are attached to this statement.

PHASE 2 ENERGY STRATEGY STATEMENT

St. Michaels, Manchester
Commercial Development

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Project Title: St. Michaels, Manchester **Project Ref: 2986**

Date: 31/08/2021 **Report Ref: 02**

INTRODUCTION

The application site is bounded by Jacksons Row, Bootle Street and Southmill Street.

The proposals include the demolition of the existing buildings on the site, with the exception of part of the old police station building (with the entrance off Southmill Street), which will be converted into office accommodation. The Sir Ralph Abercromby Public house will remain largely unaltered. The development of the site is to deliver a mixed used development which will be divided into two blocks as follows:

Phase 2

- Offices
- Retail/Restaurant/bar

ENERGY STRATEGY & SUSTAINABLE DESIGN APPROACH

The energy strategy is formulated around a collective approach to implement a sustainable development strategy which incorporates environmentally sound methods of construction, a passive design approach to reduce energy demand, and highly efficient energy supply and distribution. It is intended to highlight within this review the systems which provide a reduced energy use strategy in order to serve the relevant elements of the Building Services for the development.

As such, the following passive design techniques and technologies are proposed for the development;

- Building fabric performance (u-values) beyond minimum standards and best practice, reducing heat loss and gain
- Daylight linked lighting and controls to minimise lighting energy usage
- Reducing embodied carbon impact through material selection and construction techniques
- Demand controlled ventilation; reducing energy usage associated with ventilation, heating and cooling systems.
- Air Source Heat Pumps providing heating and cooling with heat recovery between the two systems. Variable volume systems with advanced control will minimise operational energy use.
- Heat Recovery Ventilation to all areas, with variable volume control based on necessity.

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The energy strategy for the redevelopment of the existing building on Southmill street aims to improve energy efficiency as far is reasonably practical without prejudicing the character of the building or increasing the risk of long-term deterioration of the building fabric or fittings.

To underline the approach to energy and carbon, the office development is seeking a NABERS 5 star rating. NABERS is based on real life energy consumption and encourages the landlord and tenant to operate efficiently, monitor and report energy consumption.

The commercial office development is targeting a BREEAM assessment result of 'Outstanding' and the sustainable approach to the design and arrangement of the systems will aspire to meet these requirements. The development will utilise heat recovery air source heat pumps for heating and cooling and be constructed to maximise passive methods to condition the buildings thermal and visual environment. The location of the proposed development is highly sustainable in terms of its links with public transport, and the use of the land incorporating a hotel and bar/dining facility reinforces the desire to create a sustainable development in the wider context, reducing transport emissions which provides benefits to the local culture and economy. The reuse of the existing site will also ensure embodied carbon will be minimised during the construction.

In addition to this, the office development will be developed with principles of WELL. This combined approach aims to address energy, carbon and wellbeing.

KEY OBJECTIVES

Manchester Core Strategy Document

The Manchester Core Strategy document 2012 is a key document in Manchester Local Development Framework and sets planning policies. With respect to energy and CO2 emissions, the notable subjects that are expected to be covered by a large multiuse development are;

Policy EC 1 - Employment and Economic Growth in Manchester

Development proposals should have regard to Climate change resilience demonstrating how CO2 emissions will be minimised with an aim of zero carbon emissions, through;

- Energy efficiency
- Renewable energy
- Decentralised energy infrastructure;

Policy EN 5 - Strategic Areas for low and zero carbon decentralised energy infrastructure

Within Manchester it is expected that new developments are expected to take place in the context of more detailed proposals for decentralised low and zero carbon energy infrastructure in the form of energy proposals plans. The Council will work with all relevant stakeholders, which may include developers, private sector partners, utilities companies, neighbouring authorities and other public sector bodies, as appropriate, to bring forward such plans.

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Where investment or development is being undertaken into or adjacent to a public building/asset or district heating network, full consideration will be given to the potential role that these can have in providing an anchor load within a decentralised energy network or in creating opportunities for CO_2 reduction funded by contributions

Policy EN 6 - Target Framework for CO_2 reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 m_2 will be expected as a minimum to meet the target shown below unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO_2 emissions for all phases of the development.

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).
- Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as retail units and leisure complexes.
- Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

Target area 1 applies to this scheme, as the development has at least three of the following - commercial offices, hotel, residential, apartments, public building, supermarket, or it is adjacent to an existing district heat network. If connection to an existing heat network, or installation of a new heat network is not considered feasible or viable then a development would be expected to follow Target Area 3."

For the Domestic aspect of the proposed scheme, the requirements of Code Level 4 are more onerous than the targets stated above.

For Non Domestic buildings, the requirement of a 15% reduction in carbon set out above is the most onerous target, unless, a specific BREEAM rating is stipulated by the planners of desired by the developers.

Policy EN 7- Energy Infrastructure opportunities

There will be a general presumption in favour of low and zero carbon decentralised energy schemes, subject to the following considerations:

That any new generating plant capable of producing heat and cooling as well as electricity should be located in a way that facilitates future connection to a local distributed energy system. That any energy centre, including generating plant, standby/boiler plant and substations, will be located and designed to a high quality so as to integrate with and contribute to the townscape.

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Summary

Non Domestic Target
15% reduction in emissions from Part L 2010
BREEAM target not stipulated.

Domestic Target
Code Level 4, but has been removed. Instead, it is expected that the target of 25% reduction over Part L 2010 or 19% reduction over Part L 2013 will be required.

Technologies and Systems
Of the renewable energy and low carbon technologies available, the following have been considered for inclusion on this development;

1. CHP (combined heat and power)
2. Air source heat pumps
3. Photovoltaic Cells
4. Connection to the Manchester district heating network
5. Passive measures for thermal performance in the construction of the building.

When reviewing these systems against the lengthy payback periods, the prohibitive installation and maintenance costs, and the possible limited renewable energy usage provided, Air Source Heat Pump technology and passive design measures proved the most suitable for this project.

Sustainable Design

Sustainable design is the practice of designing physical objects, particularly in the built environment, to encompass with the principles of economic, social, and environmental sustainability. Defined as meeting the needs of the present without compromising those of the future, it ranges from the design of small objects for everyday use, through to the designing of buildings, landscapes and cities. It is an essential tool within the fields of architecture, urban design and planning engineering, graphic design, industrial design, interior design and fashion design.

- The aim of sustainable design within Building services is to construct buildings and services in a way that reduces the use of non-renewable resources and minimises the impact on the environment fossil fuel emissions can have.

- Targeting the passive design features of a building can reduce the reliance on energy resources for building heating and cooling initially as greater air tightness results in less temperature fluctuations within a development.

- Alternatively, where energy for building services must be consumed, renewable energy can be used. Described as the energy flows derived from natural sources, these sources are continuously at work in within the environment and are theoretically not depleted when used.

- A New Thermal Envelope for the development would be sought to be designed and constructed to go beyond the minimum requirements laid down in the current L2A Building

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Regulations 2013, both in terms of Fabric U-Values and Air Permeability.

- Natural Daylighting and artificial light dimming would be maximised to reduce artificial lighting load. The use of low energy electric lighting would also be sought to be implemented in excess of that currently required to comply with Building Regulations.

The design approach, in respect to minimising carbon emissions from the development, aligns with the best practise guidelines adopted by the Local Planning Authority in their Core Strategy policies. This policy states that Lean, Clean and Green energy savings should be considered sequentially.

The lean savings are measures to improve the baseline energy performance and would typically mean improvements to the thermal conductivity of the fabric and glazing, high efficiency pumps, lighting, alongside lighting control systems.

The clean savings are measures that reduce carbon dioxide emissions when compared to the standard design approach, but rely on an element of non-renewable energy consumption. The technologies that could be considered here would be;

- VRF (variable refrigerant flow) systems;
- WR2 (water source variable refrigerant flow) systems; and
- Combined Heat and Power;

Both the VRF and WR2 systems are refrigerant based comfort cooling systems which use different mediums, ie; VRF uses air and WR2 uses water as the means of heat absorption and rejection.

Sustainable Design	**Applied to Development**
Improved Fabric U-values over and above 2013 Part L2a regulations	Yes – passive measure
Improved air tightness over and above the 2013 Part L2a regulations	Yes – passive measure
VRF heat recovery comfort cooling systems	Yes – low carbon technology
Heat recovery ventilation systems	Yes – passive measures
LED lighting throughout	Yes – low carbon technology

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PHASE 2

Offices MEP Strategy

- Air source heat pumps with heat recovery provide simultaneous heating and cooling via LTHW and CHW systems, serving both ventilation plant and office fan coil units.
- LED low energy lighting installed throughout
- Heat recovery ventilation systems installed to all internal office areas
- Variable air volume office ventilation systems, modulating based on CO2 level control.
- Daylight linking to all office lighting installation to locally switch off perimeter lighting rows during daylight hours.
- Lighting control systems installed to local zones to turn off groups of fittings via presence or absence detection systems.
- Local electric hot water supplies to toilets, showers and kitchenettes.
- Inverter driven pumps and fans installed throughout.

Manchester Core Strategy Policy EN6 states that applications for developments over 1000m^2 will be expected as a minimum to meet the following target for Energy Intense Buildings: + 15% increase on Part L 2010.

Between the Part L 2010 and Part L 2013 Building Regulations, the target emission rates were improved by 9% for non-domestic buildings.

With this, these technologies will provide the requirement to achieve the 9% improvement in carbon emissions.

The reduction in regulated carbon will be demonstrated using approved compliance simulation software – using a dynamic simulation modelling approach. A BRUKL report (Building Regulation UK Part L) which calculates Part L (fuel and energy conservation) of the Building Regulations 2013 measured against maximum target carbon dioxide emissions for buildings will be included.

Note that alongside this assessment, an operational energy assessment is being undertaken – using the NABERS approach will realises whole building operational carbon.

Retail/Restaurants/Bar MEP Strategy

Whilst not included in the base build, the following is anticipated from the fitout of the retail units.

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- VRF (variable refrigerant flow) Heat recovery comfort cooling system providing simultaneous heating and cooling to retail /restaurant and bar areas.

- Low energy lighting installed throughout

- Heat recovery ventilation systems installed

- Inverter driven pumps and fans installed throughout.

Phase 3 St Michael's Manchester

Energy Strategy Report
Ref: P1785-ES-001 Rev C



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AMENDMENT HISTORY

REVISION	DESCRIPTION	DATE	AUTHOR	CHECKED
A	Initial Issue	Aug 2022	C. Pearson	B. Duckworth
B	ENV Statement Separated	Nov 2022	C. Pearson	B. Duckworth
C	Comments Addressed	Dec 2022	C. Pearson	B. Duckworth

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Appendix A – SAP Reports

Appendix B – BRUKL Report

1 EXECUTIVE SUMMARY

The proposed development St Michael's is located within Manchester city centre. As such the policies detailed in the Manchester Core Strategy must be adhered to. This report will directly address policies EN4, EN6 and EN8 in respect of Phase3 which includes the hotel, restaurant and office space.

The methodology for this report is to take a 'fabric first' approach as set out in Manchester City Councils Core Strategy, making improvements to the envelope first, reviewing the results due to these fabric improvements and then reviewing suitable technologies to enhance this design philosophy where feasible. As the building notice for this development was submitted before June 15th, 2022, and works will commence on-site before June 15th, 2023, Transitional Arrangements apply, therefore the results in this report will be based on Building Regulations 2012. The proposed fabric specification is described in Table 1 below.

Table 1 Building Fabric Specification

Building Fabric			
Element	**L1A: 2013 Limiting U-values (W/m².k)**	**L1A: 2013 Notional U-values (W/m².k)**	**Proposed U-values (W/m².k)**
Floors	0.25	0.13	0.18
External Walls	0.30	0.18	0.24
Party walls between dwelling	0.20	0.00	0.00
Roof	0.20	0.13	0.15
Windows	2.00	1.40	1.1 (g-value 0.4)
Doors	2.00	1.0	N/A
Y – value (W/m².k)	0.15	~0.05	~0.07 – 0.12
Air permeability (m²/h.m² @ 50 pa)			
All dwellings	10.0	5.0	5.0
Thermal Bridging Details			
External Junction Type		**Linear Thermal Transmittance (Ψ)**	**Note**
E1 Lintel		0.5	Accredited Detail
E4 Jamb		0.05	Accredited Detail
E6 Intermediate Floor Within Dwelling		0.07	Accredited Detail
E7 Party Floor Between Dwellings (flats)		0.07	Accredited Detail
E9 Balcony between dwellings, wall insulation continuous		0.02	Accredited Detail
E14 Flat Roof		0.08	Accredited Detail
E18 Party Wall Between Dwellings		0.06	Accredited Detail
Party Wall Junction Type		**Linear Thermal Transmittance (Ψ)**	**Note**
P3 Intermediate Floor Between Dwellings		0	Default Detail
Thermal Mass Parameter (TMP)			
Light 100 - 250 kJ/m²K			

Proposed fabric values are lower than the limiting/notional values and accredited construction details have been used throughout to improve the Y-value. This is key to the fabric first approach which aims to reduce annual CO_2 production in line with the policies of the Manchester Core Strategy.

Regarding the systems used, the development will utilise low carbon Air Source Heat Pump technology to provide both heating and cooling, hot water for non-domestic areas will also be provided by ASHP technology. Domestic hot water will be provided electric immersion cylinders and mechanical ventilation with heat recovery (MVHR) will be used for ventilation.

A breakdown of systems is provided in Table 2 below.

Table 2 Systems by General Area Type

General Area	Heating/Cooling	Ventilation	Hot Water
GF non-domestic	VRF ASHP	MVHR	Elec Water Heater
Office Area	VRF ASHP	MVHR	Elec Water Heater
Hotel Area	VRF ASHP	MVHR	QAHV ASHP
Domestic Area	VRF ASHP	MVHR	Electric Immersion
Domestic Communal	Panel Heater	N/A	N/A
Non-Domestic Circulation	Panel Heater	N/A	N/A

Utilising an all-electric strategy combined with the Fabric Energy Efficiency improvements will allow the development to achieve the required CO_2 reduction dictated by the Manchester Core Strategy. Currently the portion of renewable energy supplying the national grid is circa 48% therefore as the grid becomes greener so will developments that primarily use grid electricity.

In addition to efficient systems, consideration has been given to the reduction of mains potable water usage through efficient water fixtures. This is further detailed in section 4.5 however potable water demand is to be reduced to <16 litres/person/day as per the requirement within Building Regulations.

There is an emphasis on fully utilising electric systems in this recommendation owing to the implementation of Part L 2021, which incorporates major changes to the Fuel Carbon Factors for each fuel type and effectively brings grid electricity in line with gas. Whilst Transitional Arrangements apply to this development and final lodgement will ultimately be done on 2012 Building Regulations; this Energy Strategy is designed with the carbon factors of 2021 Building Regulations in mind. Thereby addressing the carbon reduction requirements of the Manchester Core Strategy more accurately and better representing the developments carbon efficiency.

This is further discussed in Section 2.5.1 of this report, the primary benefit of the decarbonising of grid electricity is that it makes all-electric schemes far more efficient in terms of CO_2 reduction and opens up the possibility of achieving zero carbon in the future as the portion of renewable energy being added to the grid increases. An all-electric strategy has therefore been pursued to take advantage of this benefit.

An all-electric system has been pursued over a wet system as the use of a wet heating system, connected to the district heating source, would require additional plant space at ground floor level to incorporate plate heat exchangers, large buffer vessels, pumps, pressurisation units. This would lose key space at ground floor level as well as expand the amount of plant for the development to maintain.

For the whole development, the following results have been obtained, based on an area weighted average calculation to produce a single result for the full building. Please note that the SAP10 calculation software has not been fully released at this stage, therefore these results are subject to change as the final version of the software becomes available:

Table 3 Building Regulations Part L 2012 Results

Target Emission Rate vs Dwelling Emission Rate	
Combined Target Carbon Dioxide Emission Rate (TER)	26.66 $kgCO_2/m^2.yr$
Combined Dwelling Carbon Dioxide Emission Rate (BER)	25.12 $kgCO_2/m^2.yr$
% Reduction	5.79%
Target Fabric Energy Efficiency vs Dwelling Fabric Energy Efficiency	
Combined Target Fabric Energy Efficiency (TFEE)	39.15 kWh/m^2
Combined Dwelling Fabric Energy Efficiency (DFEE)	34.85 kWh/m^2
% Reduction	10.98%

Table 4 Estimated Building Regulations Part L 2021 Results

Target Emission Rate vs Dwelling Emission Rate	
Combined Target Carbon Dioxide Emission Rate (TER)	8.67 $kgCO_2/m^2.yr$
Combined Dwelling Carbon Dioxide Emission Rate (BER)	6.74 $kgCO_2/m^2.yr$
% Reduction	22.28%

A 22.28% overall reduction in CO_2 emissions can be observed. The Manchester Core Strategy requires a 15% improvement over Part L 2010 Building Regulations. These regulations have been superseded by 2013 and 2021 Building Regulations which collectively are a 37% betterment over 2010 Building Regulations by default. Therefore, by achieving a CO_2 reduction of 22.28%, this equates to a 59.28% improvement over 2010 Building Regulations and offers full compliance with the requirements of the Manchester Core Strategy.

Figure's 1 & 2 below summarises the carbon performance at each stage of the Energy Hierarchy.

Figure 1: Overall Carbon Emissions per Energy Hierarchy Stage Part L 2012 Building Regulations

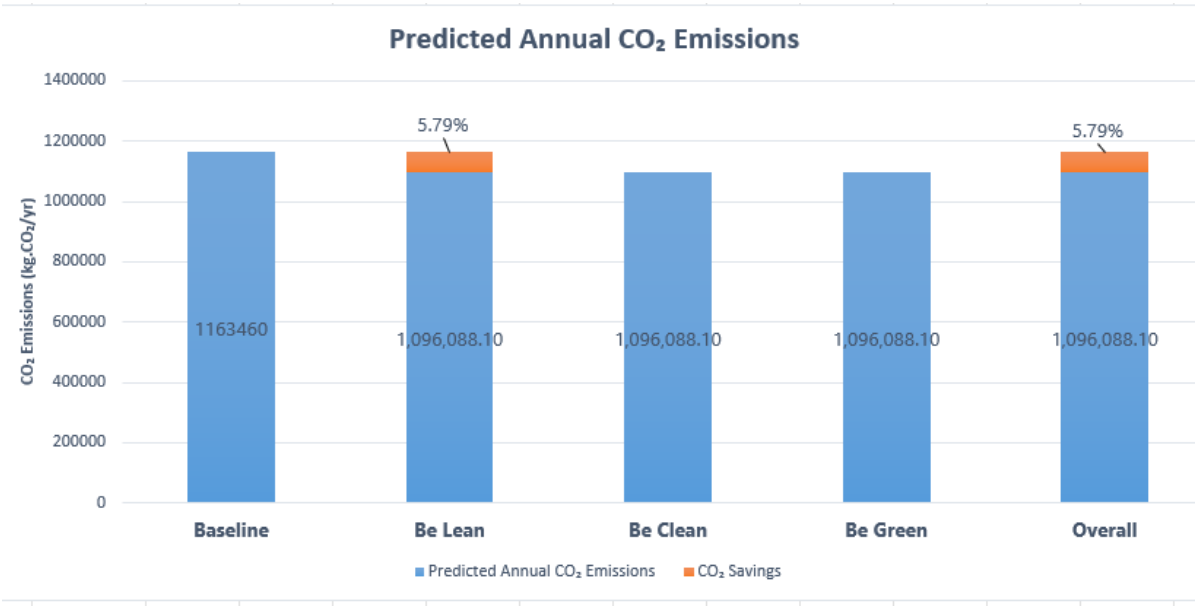


Figure 2: Overall Carbon Emissions per Energy Hierarchy Stage Part L 2021 Building Regulations



2 INTRODUCTION

2.1 PURPOSE

NOVO Integration Ltd has been appointed as Energy Consultants to produce an Energy and Environmental Standards Statement for the St Michael's development, Manchester.

This is to support the scheme design process, demonstrate Building Regulations Part L compliance and to achieve the applicable planning polices set out in the Manchester Core Strategy.

Figure 3: St Michael's Manchester



This report will outline the following:

1. Assess Phase 3 of the proposed development site's estimated CO_2 emissions, it will look into the feasibility of Low Zero Carbon technologies, examining the following aspects relative to LZC/renewable technologies:

    - Energy generated by Renewable/Low Zero Carbon Technologies (LZC)
    - Feasibility assessment for each Renewable/Low Zero Carbon Technologies (LZC)
    - Local Planning Requirements

2. The proposed building fabric and Low Zero Carbon (LZC) design strategy and analysis calculations, with respect to the Standard Assessment Procedure (SAP) and Simplified Building Energy Model (SBEM). Demonstration of how the design is compliant against Part L1/2A Buildings Regulations.

2.2 BACKGROUND POLICY DOCUMENTS

The following statements and regulatory guidelines form the policy background to this energy strategy:

- The Kyoto Protocol at the United Nations.
- Framework Convention on Climate Change as negotiated in December 1997 has come into effect on 16 February 2005 following the ratification of the agreement by Russia on 18 November 2004. The Burden Sharing Agreement of the EU mandates a 12.5% reduction in greenhouse gas emissions for the UK by 2008 - 12.
- The Department of Transport and Industry White Paper, titled "Our Energy Future - Creating a Low Carbon Economy", spells out a target for 10% of electricity to be from renewable sources nationally by 2010 and twice this by 2020.
- National Policy Objectives in regard to renewable energy Planning Policy Statement 22: Renewable energy guidance for local governing bodies concerning implementation of renewable energy technologies through appropriate planning.
- The United Kingdom has made commitments that extend beyond this requirement. National Targets are for a reduction to 20% below 1990 CO_2 levels by 2010 and a 60% reduction by 2050.
- Integrating renewable energy into new developments: Toolkit for planners, developers and consultants, September 2004.
- The Building Regulations 2013 - Approved Document L - Conservation of Fuel and Power in new buildings other than dwellings.
- The Building Regulations 2013 - Approved Document L - Conservation of Fuel and Power in new dwellings.
- Manchester Core Strategy 2012-2027
- Guide to Development in Manchester SPD (2007)
- Manchester City Council Climate Change Framework (2020-2025)
- RIBA 2030 Climate Challenge
- SAP 10 Technical Paper S10TP-15 CO2 and Primary Energy for SAP
- Approved Document Part L Volume 1: Dwellings 2021
- Approved Document Part L Volume 2: Buildings other than dwellings 2021
- National Planning Policy Framework (July 2021)
  The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. In particular point A of paragraph 16 which states the following:

  Plans should:

  a) be prepared with the objective of contributing to the achievement of sustainable development.

  b) be prepared positively, in a way that is aspirational but deliverable

  c) be shaped by early, proportionate, and effective engagement between plan makers and communities, local organisations, businesses, infrastructure providers and operators and statutory consultees

  d) contain policies that are clearly written and unambiguous, so it is evident how a decision maker should react to development proposals

  e) be accessible through the use of digital tools to assist public involvement and policy presentation; and

f) *serve a clear purpose, avoiding unnecessary duplication of policies that apply to a particular area (including policies in this Framework, where relevant).*

Another key point of the NPPF is paragraph 8, point C which states the following:

Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

a) *an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;*

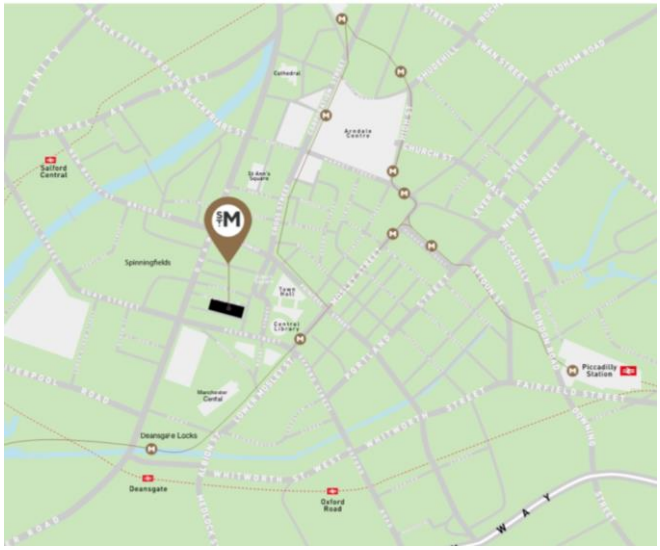
b) *a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and*

c) *an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*

2.3 SITE DESCRIPTION

The site is located in the centre of Manchester, the surrounding area is a mix of non-domestic and domestic spaces. It is in close proximity to iconic buildings such as the Town hall and Central Library. Being a city centre location there is a strong presence of local retail and various amenity, also nearby to the development is the Spinningfields Business District, Civic Quarter and Chinatown.

Figure 4: Ariel View



2.4 PLANNING POLICY

2.4.1 Local Policy

The locality of the development site means it falls under the jurisdiction of Manchester City Council. As such the policies adopted by Manchester City Council must be adhered to.

The document that details Manchester's strategy for development is 'Manchester's Local Development Framework – Core Strategy Development Plan Document', throughout the remainder of this report it shall be referred to as Manchester Core Strategy. The Core Strategy was adopted 11th July 2012.

Policy EN 4:
Reducing CO2 Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO2 emissions, and rising fossil fuel prices, through the following actions:

- *All developments must follow the principle of the Energy Hierarchy, being designed to reduce the need for energy through design features that provide passive heating, natural lighting and cooling*
- *To reduce the need for energy through energy efficient features such as improved insulation and glazing*
- *To meet residual energy requirements through the use of low or zero carbon energy generating technologies*
- *Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies*
- *Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings*
- *Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes*

Policy EN 6
Target Framework for CO_2 reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO_2 emissions for all phases of the development.

Developments smaller than the above threshold but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows:

- *Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling)*

- *Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as retail units and leisure complexes*
- *Target 3 MICRO-GENERATION AREAS: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical*

Policy EN 8:
Adaptation to Climate Change

The council outlines an indicative list of remedial actions for new developments in order to be adaptable to climate change in terms of design, layout, siting and function:

- *Minimisation of flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability*
- *Reduction in urban heat island effect through the use of Green Infrastructure such as green roofs, green walls, increased tree cover and waterways*
- *The need to control overheating of buildings through passive design*
- *The opportunity to provide linked and diverse green space to enhance natural habitats which will assist species adaptation*

Domestic CO_2 emission targets
Table 12.1

Target	***% Minimum requirement***
Target 1: Network development area	*CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010*
Target 2: Electricity intense buildings	*+15% increase on Part L 2010*
Target 3: Micro generation area	*+15% increase on Part L 2010*

Non-domestic CO_2 emissions reduction targets
Table 12.2

Target	***% Minimum requirement***
Target 1: Network development area	*CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010*
Target 2: Electricity intense buildings *(applies to commercial uses with a high proportion of emissions from electricity use (>45kgCO2/m2)*	*+15% increase on Part L 2010*
Target 3: Micro generation area	*+15% increase on Part L 2010*

Where the CO_2 emissions reduction required under any future revision to Part L of the building regulations become greater than the '% minimum requirement', the reduction required under building regulations would apply.

Where the Council identifies an 'allowable solution', for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the '% Minimum requirement' (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the 'allowable solution' at design stage.

The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO_2 mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance.

Guidance on what the energy statement should contain and how to decide which target applies to a development proposal is given in appendix A.

The above policy states that this specific development requires a 15% betterment with CO_2 emission reduction over 2010 Building Regulations. However, the development will be constructed to adhere to 2013 Building Regulations whilst providing estimate Part L 2021 Building Regulations results.

There have been 2nr updates to Part L since the introduction of the above Policy target CO_2 reduction. The first being the Part L 2013 update and the second being the Part L 2021 update. The collective betterment of the 2nr Part L updates over Building regulations 2010 is 37% (6% from 2010 to 2013 and 31% from 2013 to 2021). Therefore, by achieving a pass under current 2021 Building Regulations the development will not only meet the required CO_2 reduction in Policy EN8 but exceed it by 22%.

Furthermore Section 4 Environmental Standards of the Manchester Supplementary Planning Document details the requirement for and Environmental Standards Statement highlighting a number of Environmental issues be addressed. These issues are addressed in Section 5 of this report.

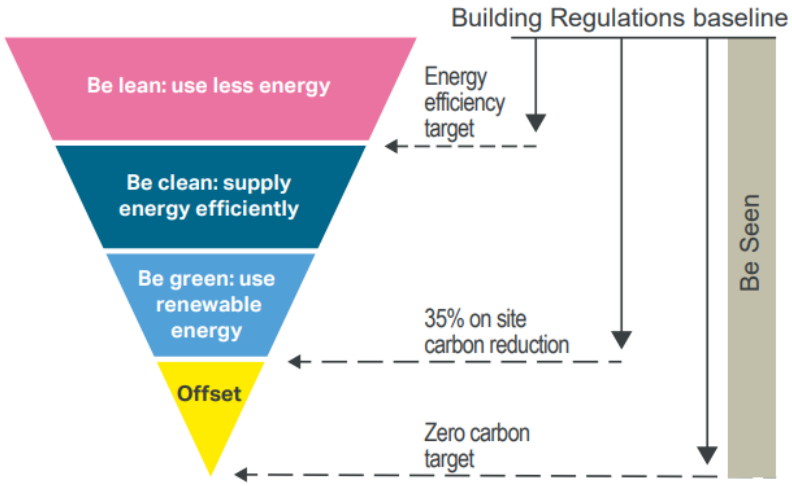
2.4.2 Energy Hierarchy

As part of the Sustainability and Energy analysis of the development Energy Hierarchy has been used as a means of structuring the sustainable design process.

We have taken this approach in order to properly address the Manchester Core Strategy Policies which promote low carbon design, assessment of connection to CHP and consideration of other low – zero carbon technologies.

An overview of the Energy Hierarchy is provided below:

Figure 5: Energy Hierarchy Diagram



- Using less energy, in particular by adopting sustainable design and construction measures.
- Supplying energy efficiency, in particular by prioritising decentralised energy generation; and
- Using renewable energy.

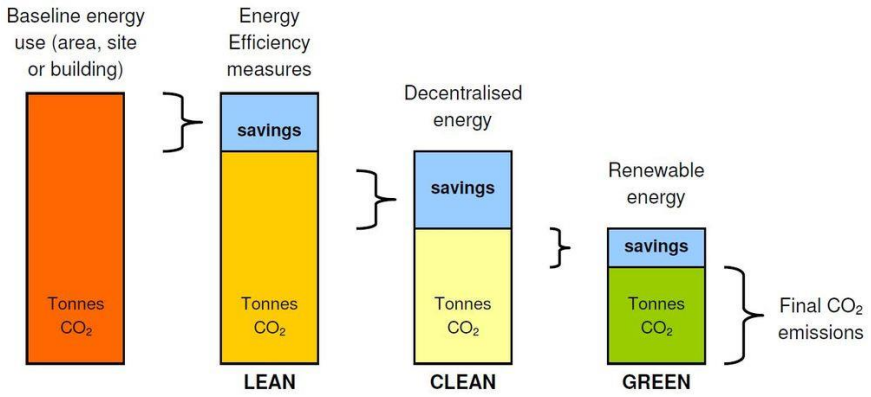
The development Energy strategy has adopted the following design ethos:

- **BE LEAN** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.

- **BE CLEAN** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.

- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

Figure 6: Energy Hierarchy Example Graph



2.5 BUILDING REGULATIONS

Approved document L1A (2013)– Conservation of fuel and Power sets the standard for carbon emissions for new dwellings. Buildings will need to comply with the criteria set out in the document, as follows:

Approved document L1A – Conservation of fuel and Power sets the standard for carbon emissions for new dwellings and was revised last April 2014 (Part L: 2013). Dwellings will need to comply with the criteria set out in the document, as follows:

1) The predicted Dwelling CO_2 Emission Rate (DER) should not be greater than the Target CO_2 Emission Rate (TER).

2) The performance of the building fabric and fixed building services should be no more than the design limits set out in Table 2 of the approved Document.

3) The dwelling will have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer.

4) That the performance of dwellings as built comply with DER values achieved, including site testing or a representative sample of dwellings, demonstrating that the 'air permeability' rate achieved is as per that specified, or better.

5) The necessary provisions for energy efficient operation of dwellings are put I place, including operation and maintenance instructions

Approved document L2A (2013)– Conservation of fuel and Power sets the standard for carbon emissions for new buildings other than dwellings. Buildings will need to comply with the criteria set out in the document, as follows:

In order to demonstrate compliance with the requirements for Approved Document L2A (2013) there are five separate criteria that must be met.

The following briefly outlines each of the five criteria:

(i) Criterion 1 - Achieving the Buildings Emission Rate (BER)

To demonstrate compliance with Criterion 1 the actual building emission rate is compared to the notional building emission rate and must be at least equal.

The actual buildings emission rate is calculated when the building is modelled using approved software and the proposed construction values are detailed, for example, u-values, efficiency of M&E plant, etc. following this exercise the software will generate a notional building, the notional building has the same layout as the actual building, but the construction values and energy performance of the M&E equipment is pre-set, this allows the software to generate a target emission rate (TER) for the actual building, the TER is the anticipated emission rate from the notional building.

The BER is then compared to the TER and if it is equal to or lower than then the building is deemed to comply with Criterion 1.

This process needs to be completed and issued to Building Control at the "As-Designed" Stage to demonstrate to Building Control that the proposals for the building comply with the criteria.

(ii) Criterion 2 - Limits on Design Flexibility

Each element of the construction has pre-set performance limits within the document; these are generally split into 2 categories, an average value and an upper limit value which cannot be exceeded.

To demonstrate compliance with criterion 2 then criterion 1 must be achieved with no individual element exceeding the upper limit set for performance.

(iii) Criterion 3 - Limiting the Effects of Solar Gains in Summer

It is a requirement to demonstrate that solar gains have been limited during the summer period to either reduce the need for air conditioning; or to reduce the installed capacity of any air conditioning system that is installed.

To demonstrate compliance with criterion 3 an assessment of the solar gains must be undertaken, the actual building results are then compared to a pre-defined standard and if the performance of the actual building is no worse than that of the pre-defined building then it is deemed to comply with the criterion.

(iv) Criterion 4 – Building Performance Consistent with BER

The process for demonstrating compliance with criterion 4 is generally the same as criterion 1, the difference is that the actual building performance is compared to the notional building, for example, the air permeability results, building services commissioning figures, achieved construction u-values are used rather than the design assumptions.

It then must be demonstrated that the actual building performance is equal to or better than the TER.

Notice should be given that commissioning has been carried out according to a procedure approved by the Secretary of State.

(v) Criterion 5 – Provisions for Energy-Efficient Operation of the Building

The owner of the building should be provided with sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

This is generally achieved by production of a building logbook.

2.5.1 The Introduction of SAP 10

The new methodology under Part L 2021 has several aspects that make Part L more stringent to achieve in general, however one major change is the Fuel Carbon Factors for each of the fuel applied within the calculation for energy generation. The change is specific to the grid electricity, this fuel factor is to be lowered to fall in line with gas.

This change makes an all-electric heating and hot water system in line with a gas system in terms of efficiency, therefore gas and CHP systems will have less of a benefit within the new calculations. This coupled with the benefits of removing gas from certain sites has huge advantages for developments such as this.

This change in the fuel factor is a direct result of the "greening of the grid" which has occurred due to the current proportion (circa 48%) of grid energy now coming from renewable sources, primarily offshore wind, solar PV and Biomass generators. There is a focus on the use of all electric heating and hot water systems within our recommendation to take advantage of the new fuel factors coming out in SAP 10 and support the policies of the Manchester Core Strategy by using an all-electric system supplied by grid electricity which will eventually become a zero-carbon energy source.

2.5.2 RIBA 2030 Climate Challenge

In addition to the upcoming fuel carbon factors this Energy Strategy has also given consideration to the RIBA 2030 Climate Challenge.

The RIBA 2030 Climate Challenge sets out a number of Sustainable Outcome targets including:

- Operational Energy
- Embodied Carbon
- Potable Water Use

It also sets out a number of best practice Health Targets including:

- Overheating
- Daylighting
- CO_2 Levels
- Total VOC's (Volatile Organic Compounds)
- Formaldehyde

The RIBA 2030 Climate Challenge was created following the RIBA Council vote on 29th June 2019 to join the global declaration of an environmental and climate emergency. These targets are none binding and still under development as RIBA discusses these metrics further with industry bodies before the targets are finalised. They do however make a useful resource for best practice given that these targets were developed to address the current climate emergency, therefore, although the targets are non-binding they have been considered where appropriate.

Figure 7: RIBA 2030 Climate Challenge Target Metrics

RIBA 2030 Climate Challenge target metrics for domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m²/y	146 kWh/m² /y (Ofgem benchmark)	< 105 kWh/m²/y	< 70 kWh/m²/y	< 0 to 35 kWh/m²/y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon $kgCO_2e/m^2$	1000 $kgCO_2e/m^2$ (M4i benchmark)	< 600 $kgCO_2e/m^2$	< 450 $kgCO_2e/m^2$	< 300 $kgCO_2e/m^2$	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

RIBA 2030 Climate Challenge target metrics for non-domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m²/y	225 kWh/m²/y DEC D rated (CIBSE TM46 benchmark)	< 170 kWh/m²/y DEC C rating	< 110 kWh/m²/y DEC B rating	< 0 to 55 kWh/m²/y DEC A rating	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon $kgCO_2e/m^2$	1100 $kgCO_2e/m^2$ (M4i benchmark)	< 800 $kgCO_2e/m^2$	< 650 $kgCO_2e/m^2$	< 500 $kgCO_2e/m^2$	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day	>16 l/p/day (CIRA W11 benchmark)	< 16 l/p/day	< 13 l/p/day	< 10 l/p/day	CIBSE Guide G

Above is an extract showing the target metrics for domestic and non-domestic buildings. Particularly relevant to this report are the "Operational Energy" and "Potable Water Use" targets as through a fabric first approach, low/zero carbon technology and use of renewables these issues have been considered.

The Embodied Carbon target is addressed as far as our capacity as the Sustainability Consultant is concerned however in order to fully tackle the Whole Life Carbon of the building using Circular Economy Strategies; consideration of Embodied Carbon will be required by all parties involved with the design, construction and operation of each block, particularly parties with ISO14001 accreditation.

We have endeavoured to achieve the targets outlined through the fabric first approach combined with Low Carbon technology and efficient fittings all of which are detailed further in this report.

3 DESIGN PARAMETERS

3.1 METHODOLGY

The Standard Assessment Procedure (SAP) is the Government's approved methodology for assessing the predicted energy consumption and carbon dioxide emissions for new domestic developments. SBEM is the Simplified Building Energy Model which is the methodology for assessing non-domestic developments.

Results are derived in respect of floor area and consider energy use (kWh/m^2/yr) and associated CO_2 emissions (kg.CO_2/m^2/yr) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generation technology

SAP/SBEM is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. For the purpose of this report, data has been produced by an Accredited Energy Assessor using FSAP and IES software to produce the data for this report.

To enable a review of each level of the Energy Hierarchy, firstly the Baseline CO_2 emission figures must be established. These figures are based on Part L1A/L2A 2013's 'Notional Building', a specific set of specification criteria referenced in section 3.4 of this report.

All additional measures included to reduce the overall CO_2 emissions such as improved building fabric and low carbon technology will be compared against the Baseline figures. These figures are the Target Emission Rate derived from the SAP assessment and resulting Design Stage SAPs.

A 'fabric first' approach will be undertaken throughout this report, looking at improvements to the thermal envelope initially to understand the improvements that can be gained prior to the feasibility of any renewable / low carbon technologies.

Renewable / low carbon technologies will then be considered with regards to special constraints, feasibility, and appropriateness in relation to the site.

NOVO Integration Ltd have used the following information to formulate the Energy Strategy.

3.2 ARCHITECTURAL DRAWINGS BY HODDERS AND PARTNERS

Table 5 Architects Drawing Schedule

The following drawings have been used to produce the Energy Model.

Drawing Number	Drawing Contents
0643-HOD-ZZ-00-DR-A-20200	Level 00 Plan
0643-HOD-ZZ-00-DR-A-20201	Level 01 Plan
0643-HOD-ZZ-00-DR-A-20202	Level 02-05 Plan
0643-HOD-ZZ-00-DR-A-20206	Level 06 Plan
0643-HOD-ZZ-00-DR-A-20207	Level 07 Plan
0643-HOD-ZZ-00-DR-A-20208	Level 08-14 Plan
0643-HOD-ZZ-00-DR-A-20215	Level 15 Plan
0643-HOD-ZZ-00-DR-A-20216	Level 16 Plan
0643-HOD-ZZ-00-DR-A-20217	Level 17 Plan
0643-HOD-ZZ-00-DR-A-20218	Level 18 – 25 Plan
0643-HOD-ZZ-00-DR-A-20226	Level 26 – 36 Plan
0643-HOD-ZZ-00-DR-A-20237	Level 37 – 40 Plan
0643-HOD-ZZ-00-DR-A-20241	Level 41 Plan
0643-HOD-ZZ-00-DR-A-20242	Level 41M Mezzanine Plan
0643-HOD-ZZ-00-DR-A-20243	Roof Plan
0643-HOD-ZZ-00-DR-A-20244	Level B1 Plan
0643-HOD-ZZ-00-DR-A-20245	Level B2 Plan
0643-HOD-ZZ-00-DR-A-20246	Level B3 Plan
0643-HOD-ZZ-00-DR-A-20300	North Elevation
0643-HOD-ZZ-00-DR-A-20301	East Elevation
0643-HOD-ZZ-00-DR-A-20302	South Elevation
0643-HOD-ZZ-00-DR-A-20303	West Elevation
0643-HOD-ZZ-00-DR-A-20304	North Elevation Podium
0643-HOD-ZZ-00-DR-A-20305	East Elevation Podium
0643-HOD-ZZ-00-DR-A-20306	South Elevation Podium
0643-HOD-ZZ-00-DR-A-20307	West Elevation Podium
0643-HOD-ZZ-00-DR-A-20400	Section AA
0643-HOD-ZZ-00-DR-A-20401	Section BB

3.3 FUEL

Table 6 Fuel Factors SAP 2012 and SAP 10

kgCO$_2$/kWh	SAP 2012	SAP 10.1
Gas:		
mains gas	0.216	0.210
bulk LPG	0.241	0.241
bottled LPG	0.241	0.241
bottled LPG (no contract)	0.241	0.241
LPG subject to Special Condition 18	0.241	0.241
biogas (including anaerobic digestion)	0.098	0.024
Liquid fuel:		
heating oil	0.298	0.298
biodiesel from any biomass source	0.123	0.038
biodiesel from vegetable oil only	0.083	0.018
appliances able to use mineral oil or biodiesel	0.298	0.298
B30K	0.245	0.220
bioethanol from any biomass source	0.140	0.105
Solid fuel:		
house coal	0.394	0.395
anthracite	0.394	0.395
manufactured smokeless fuel	0.433	0.366
wood logs	0.019	0.028
wood pellets (in bags for secondary heating)	0.039	0.053
wood pellets (bulk supply for main heating)	0.039	0.053
wood chips	0.016	0.023
dual fuel appliance (mineral and wood)	0.226	0.087
Electricity:		
standard tariff	0.519	0.136
7-hour tariff (high rate)	0.519	0.136
7-hour tariff (low rate)	0.519	0.136
10-hour (high rate)	0.519	0.136
10-hour (low rate)	0.519	0.136
18-hour (high rate)	0.519	0.136
18-hour (low rate)	0.519	0.136
24-hour heating tariff	0.519	0.136
electricity exported to grid	0.519	0.136
electricity, any tariff	0.519	0.136
Community heating schemes:		
heat from boilers - mains gas	0.216	0.210
heat from boilers - LPG	0.241	0.241
heat from boilers - oil	0.331	0.335
heat from boilers that can use mineral oil or biodiesel	0.331	0.335
heat from boilers using biodiesel from any biomass source	0.123	0.038
heat from boilers using biodiesel from vegetable oil only	0.083	0.018
heat from boilers - B30D	0.269	0.269
heat from boilers - coal	0.380	0.375
heat from electric heat pump	0.519	0.136
heat from boilers - waste combustion	0.047	0.074
heat from boilers - biomass	0.031	0.029
heat from boilers - biogas (landfill or sewage gas)	0.098	0.024
waste heat from power station	0.058	0.015
geothermal heat source	0.041	0.011
heat from CHP	as above	0.011
electricity generated by CHP	0.519	0.136
electricity for pumping in distribution network	0.519	0.136

The above table summarises the emission factors for all fuel types, this is provided in the latest BRE Technical Paper on CO2 and Primary Energy Factors for SAP. As you can see the SAP 10 fuel factor for grid electricity is vastly improved over the 2012 version, hence the SAP 10 software has been used to produce the results shown later in this report.

3.4 BASELINE CO_2 EMISSIONS

For the purpose of this report the baseline energy use and CO2 emissions are calculated based on the 'Notional Dwelling' requirements specified in the Building Regulations L1A 2013 (Table 5).

Table 7 Residential Baseline Building Fabric

Element	Part L1A: 2013 Limiting u values (W/m².k)	Part L1A: 2013 Notional u-values (W/m².k)
Floors	0.25	0.13
External Walls	0.30	0.18
Party Wall between dwelling	0.20	0.00
Roof	0.20	0.13
Windows	2.0	1.40
Doors	2.0	1.00
Y-value (W/m².k)	0.15	~0.05
Air permeability (m³/h.m² @ 50 pa)		
All dwellings	10.0	5.0

Table 8 Non-Domestic Baseline Building Fabric

Element	Part L2A: 2013 Limiting u values (W/m².k)	Part L2A: 2013 Notional u-values (W/m².k)
Floors	0.25	0.22
External Walls	0.35	0.25
Roof	0.25	0.18
Windows	2.2	1.60
External Doors	2.2	2.2
Air permeability (m²/h.m² @ 50 pa)		
Commercial space	10.0	5.0

In addition to the limiting and notional u-values Part L2A has its own baseline System inputs. Please see Figure 7 below which is a full notional dwelling specification.

Figure 7 Part L2A Notional Specification including systems

Table 5 Summary of concurrent notional building specification

Element	Side lit or unlit (where HVAC specification is heating only)	Side lit or unlit (where HVAC specification includes cooling)	Top lit
Roof U-value (W/(m²·K))	0.18	0.18	0.18
Wall U-value (W/(m²·K))	0.26	0.26	0.26
Floor U-value (W/(m²·K))	0.22	0.22	0.22
Window U-value (W/(m²·K))	1.6 (10% FF)	1.6 (10% FF)	N/A
G-value (%)	40	40	N/A
Light transmittance (%)	71	71	N/A
Roof-light U-value (W/(m²·K))	N/A	N/A	1.8 (15% FF)
G-value (%)	N/A	N/A	55
Light transmittance (%)	N/A	N/A	60
Air permeability (m³/(m²·hour)) Gross internal area less than or equal to 250 m²	5	5	7
Air permeability (m³/(m²·hour)) Gross internal area greater than 250 m² and less than 3500 m²	3	3	7
Air permeability (m³/(m²·hour)) Gross internal area greater than or equal to 3500 m² and less than 10,000 m²	3	3	5
Air permeability (m³/(m²·hour)) Gross internal area greater than or equal to 10,000 m²	3	3	3
Lighting luminaire (lm/circuit watt)	60	60	60
Occupancy control (Yes/No)	Yes	Yes	Yes
Daylight control (Yes/No)	Yes	Yes	Yes
Maintenance factor	0.8	0.8	0.8
Constant illuminance control	No	No	No
Heating efficiency (heating and hot water) (%)	91	91	91
Central ventilation SFP (W/(l·s))	1.8	1.8	1.8
Terminal unit SFP (W/(l·s))	0.3	0.3	0.3
Cooling (air-conditioned) (SEER/SSEER)	N/A	4.5 / 3.6	4.5 / 3.6
Cooling (mixed mode) (SSEER)[1]	N/A	2.7	2.7
Heat recovery efficiency (%)	70	70	70
Variable speed control of fans and pumps, controlled via multiple sensors	Yes	Yes	Yes
Demand control (mechanical ventilation only). Variable speed control of fans via CO_2 sensors	Yes	Yes	Yes

Note 1: Mixed mode assumed to be cooled by DX unit where SSEER includes indoor and outdoor units and fans, pumps and losses

By using low u-values and high-performance materials to reduce greenhouse emissions, the Be Lean stage of this report is in accordance with Paragraph 150 of the National Planning Policy Framework (NPPF). Furthermore, the use of low u-values in conjunction with accredited details demonstrates an effort to reach the Operational Energy and CO_2 emission targets of the RIBA 2030 Climate Challenge.

The following table details the notional baseline area weighted CO_2 regulated emissions for the development. The target emission rates (TER's) in the above figures combined with the total floor area was used to produce the baseline CO_2 emissions below.

Table 9 Estimated Baseline Carbon Emissions 2012 Building Regulations

Building Services	Baseline CO2 Emissions (kg CO_2/m2/yr)	Baseline CO_2 Emissions for overall development (kg CO_2/ yr)
Total regulated emissions (heating, hot water, lighting, fans & pumps)	25.12	1,163,460

Table 10 Estimated Baseline Carbon Emissions 2021 Building Regulations

Building Services	Baseline CO2 Emissions (kg CO_2/m2/yr)	Baseline CO_2 Emissions for overall development (kg CO_2/ yr)
Total regulated emissions (heating, hot water, lighting, fans & pumps)	8.67	378,720.4

By using low u-values and high-performance materials to reduce greenhouse emissions and improve energy efficiency; the Be Lean stage of this report addresses policies EN4 and EN6 of the Manchester Core Strategy and is in accordance with Paragraph 8 of the National Planning Policy Framework (NPPF) by reducing CO_2 emissions and supporting a low carbon economy.

Section 4 below will now detail how the reduction between the dwelling emission rate (DER) and the target emission rate (TER) has been achieved.

4 ENERGY STRATEGY

4.1 ENERGY EFFICIENT DESIGN

This section outlines the design energy efficient measures taken to minimise the building's energy demand and therefore reduce energy use and CO_2 emissions further than the baseline notional building, often referred to as the 'Fabric First' approach.

The energy efficient measures include:

a) Inclusion of better U-values than the minimum U-values set in the ADL1A
b) Designing for a buildings air permeability exceeding ADL1A target values
c) Utilising the highly efficient heating and hot water systems
d) Utilising low energy efficient lighting such as LED lighting

The table below outlines the improvements made to the building fabric elements compared against both the Building Regulations limiting U-values and the 'Notional Dwelling' U-values which the baseline is derived from.

Table 11 Proposed Building Fabric Specification

Building Fabric			
Element	**L1A: 2013 Limiting U-values (W/m².k)**	**L1A: 2013 Notional U-values (W/m².k)**	**Proposed U-values (W/m².k)**
Floors	0.25	0.13	0.18
External Walls	0.30	0.18	0.24
Party walls between dwelling	0.20	0.00	0.00
Roof	0.20	0.13	0.15
Windows	2.00	1.40	1.1 (g-value 0.4)
Doors	2.00	1.0	N/A
Y – value (W/m².k)	0.15	~0.05	~0.07 – 0.12
Air permeability (m²/h.m² @ 50 pa)			
All dwellings	10.0	5.0	5.0

The above table shows that all fabric elements are improved over the limiting values, the fabric strategy has focussed on improving the glazing element as this element forms a large part of the overall fabric. Focussing the fabric efficient design here is therefore an effective method of maintaining the fabric first ethos.

4.1.1 Heating Demand

The heating energy demand will be reduced by providing high performance insulation of the building envelope as well as a low Air Permeability Target to minimise heat losses. Thermal Bridging will also be reduced through insulation to all relevant junctions to achieve Psi values associated with accredited construction details (for all PSI values refer to Table 1 in this report).

For the domestic aspect of the development, low carbon Air Source Heat Pumps have been chosen to provide heating and cooling to the apartments. This will be supplemented by mechanical ventilation with heat recovery that will reuse waste heat to lower the energy demand of the main heating system. Hot water will be provided by a dual electric immersion cylinder which has a 100% delivery efficiency.

The non-domestic aspect will largely follow the general strategy of the apartments using both ASHP's and MVHR for heating and ventilation. Circulation/WC areas will be serviced by electric panel heaters which also have a 100% delivery efficiency. Hot water will be provided by a QAHV ASHP in the case of non-domestic areas with some instances of electric water heaters.

As this strategy effectively reduces the reliance on fossil fuels and contributes to the overall CO_2 reduction of the development, it therefore addresses Policy EN6 of the Manchester Core Strategy whilst also adhering to paragraph 150 of the National Planning Policy Framework (NPPF).

4.1.2 Ventilation

The development will take advantage of a Mechanical Ventilation Heat Recovery (MVHR) system.

Occupants will also have a natural ventilation option via the openable balcony doors where applicable. Extract fans will be included to all wet areas and in the kitchens.

MVHR is, in its simplest form is a heat exchanger. The system extracts warm stale air from within the Building, at the same time drawing in cooler fresh air from outside. These are then ducted into the actual MVHR unit itself, at which point the heat is exchanged without mixing the air, therefore fresh, warm air is vented into the building.

This system recovers heat from within the units which otherwise would be lost, therefore reducing the amount of energy required to maintain temperature within the units.

4.1.3 Lighting

The proposed light fittings will be low energy efficient fittings, in this instance LED fittings only throughout.

4.1.4 Embodied Carbon

All materials used within the construction of the development will have embodied carbon within them, taking into consideration manufacturing processes and supply chains. It is assumed that the developer will seek to procure materials and construction elements with appropriate sustainable accreditations, for example FSC for timber, ISO:140001 accreditations where applicable etc, to minimise the use of high embodied carbon within the building.

4.2 CO_2 REDUCTIONS AFTER FABRIC FIRST APPROACH

The following table demonstrates the reduction in CO2 emissions based on an area weighted average calculation utilising a fabric first approach with no reduction incorporated from the inclusion of any renewable / low carbon technology:

Figure 12: Fabric First Results SAP 2012

Regulated Emissions	Baseline CO_2 Emissions	Fabric First Building CO_2 Emissions	CO_2 Emission Savings	% Reduction in CO_2 Emissions
kg of CO2/m2/yr	26.66	25.12	1.54	5.79%
kg of CO2/yr	1,163,460	1,096,088.1	67,371.9	

Figure 13: Fabric First Results SAP 10

Regulated Emissions	Baseline CO_2 Emissions	Fabric First Building CO_2 Emissions	CO_2 Emission Savings	% Reduction in CO_2 Emissions
kg of CO2/m2/yr	8.67	6.74	1.93	22.28%
kg of CO2/yr	378,720.4	294,356.19	84,364.21	

From the figures above, the overall CO_2 reduction complies with SAP 2012 and through the SAP 10 Part L 2021 calculation, the required 9% reduction in CO_2 has been exceeded. This is due to the more up to date and accurate fuel factors applied to grid electricity.

The Dwelling Fabric Energy Efficiency (DFEE) results also show an improvement over the baseline this shows that the fabric first approach is at the forefront of this strategy and is therefore not overly reliant on updated fuel carbon factors or highly efficient Mechanical systems.

- Target Fabric Energy Efficiency 39.15 kWh/m^2/yr.
- Dwelling Fabric Energy Efficiency 34.85 kWh/m^2/yr.
- Reduction % =10.98%

Figure 10: Fabric First Carbon Emissions SAP 2012 Results

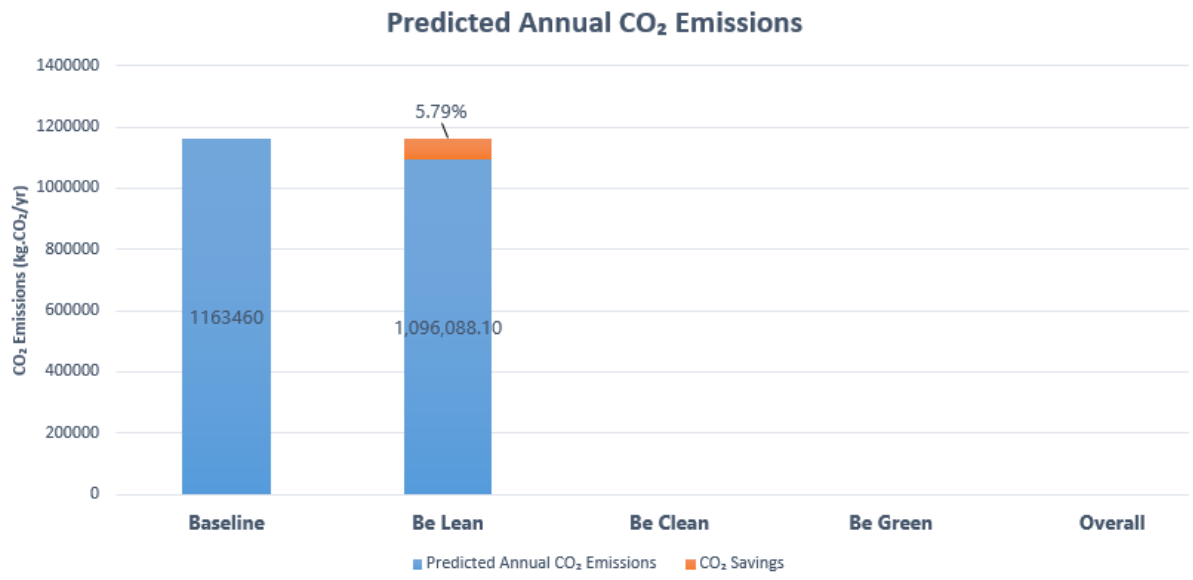
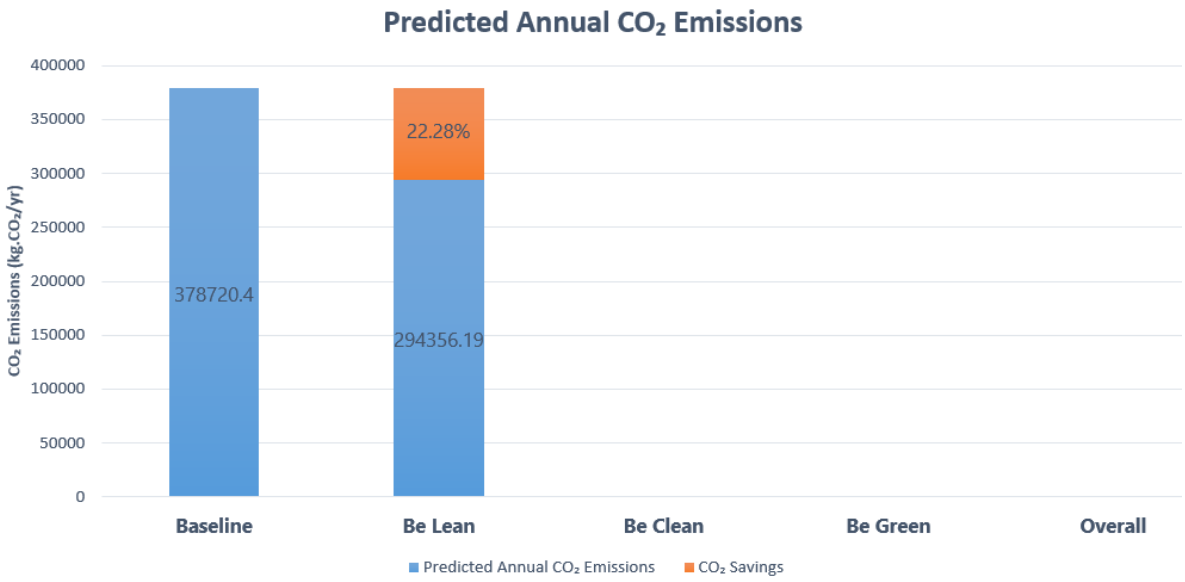


Figure 11: Fabric First Carbon Emissions Estimated SAP 10 Results



4.3 CLEANER ENERGY - CHP & DECENTRALISED ENERGY NETWORKS

The Energy Hierarchy encourages the use of a CHP system and/or the connection to District Heating system to reduce CO_2 emissions further.

4.3.1 CHP

The Energy Hierarchy identifies combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP.

The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for the majority of the year
- CHP operation based on maximum heat load for minimum 10 hours per day
- CHP operation at maximum capacity of 90% of its operating period

A CHP system will not be considered for this development due to the following reasons:

- Due to restrictions on site space would be limited for the level of plant required for a CHP system, which would require accumulators, additional boiler power, pumps, pressurisation units etc.
- Pollution discharged from the CHP unit may not be appropriate given the site locality and the number of people passing the site given its location within a residential area.
- Noise pollution is a consideration given the function of the development and its proximity to other surrounding buildings.
- Economic viability is heavily dependent on the constant demand for heat and power, as well as the price of electricity and gas.

- An all-electric system has been used in this strategy to take advantage of upcoming fuel factors for grid electricity and provide some level of future proofing as grid electricity closes in on carbon neutrality over time.

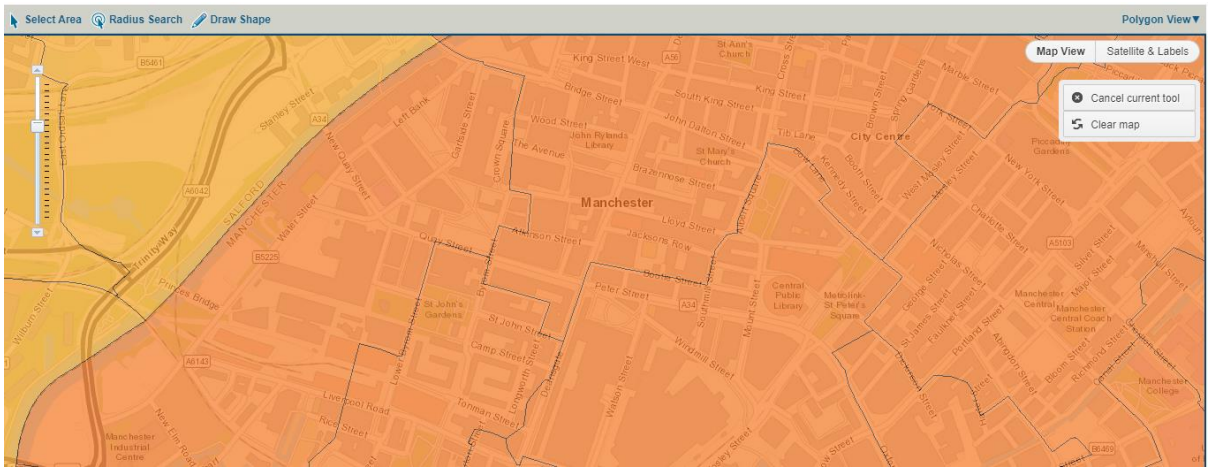
Hence, the implementation of a CHP strategy is not recommended for this development.

As a result, no CO_2 reduction can be achieved as part of the Be Clean section of the Energy Hierarchy.

4.3.2 Decentralised Energy Network

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed through the use of UK CHP Development Map, for Manchester as for a District Heating network.

Figure 12: CHP Development Map – Local Heat Loads



Presently there is the potential to connect to a heat network and should the District Heating Network evolve into an all-electric system and the infrastructure for such be provided then connection could be considered in the future.

Heat networks are best suited to large developments with appropriate plant space for buffer vessel, plate heat exchangers and manifold positions, meters, furthermore the pipework required for connection to each unit makes this option financially unviable.

An all-electric strategy is the preferred option as the fuel carbon factor for grid electricity is to be brought in line with natural gas and will eventually become zero carbon as the portion of renewable energy supplied to the grid increases. This therefore provides the development with some future proofing, better addresses the current climate emergency by removing another potential source of emissions and supports the RIBA 2030 Climate Challenge through a low carbon heating and hot water solution.

As such no additional CO_2 reduction can be observed at the Be Clean stage, this is described in the graph below:

Figure 13: Be Clean Carbon Emissions SAP 2012 Result

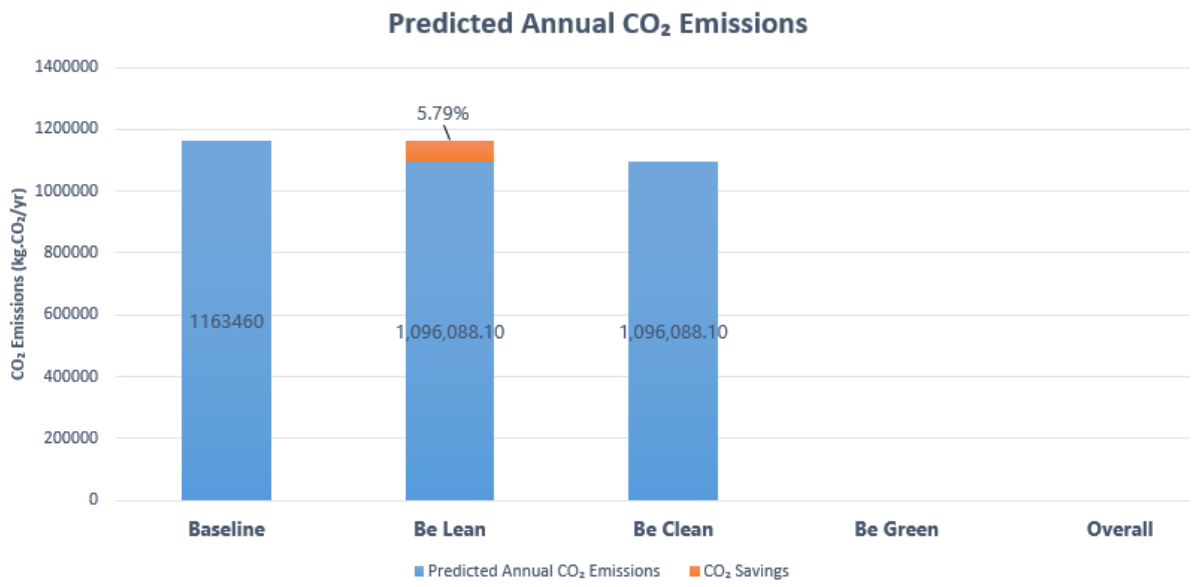
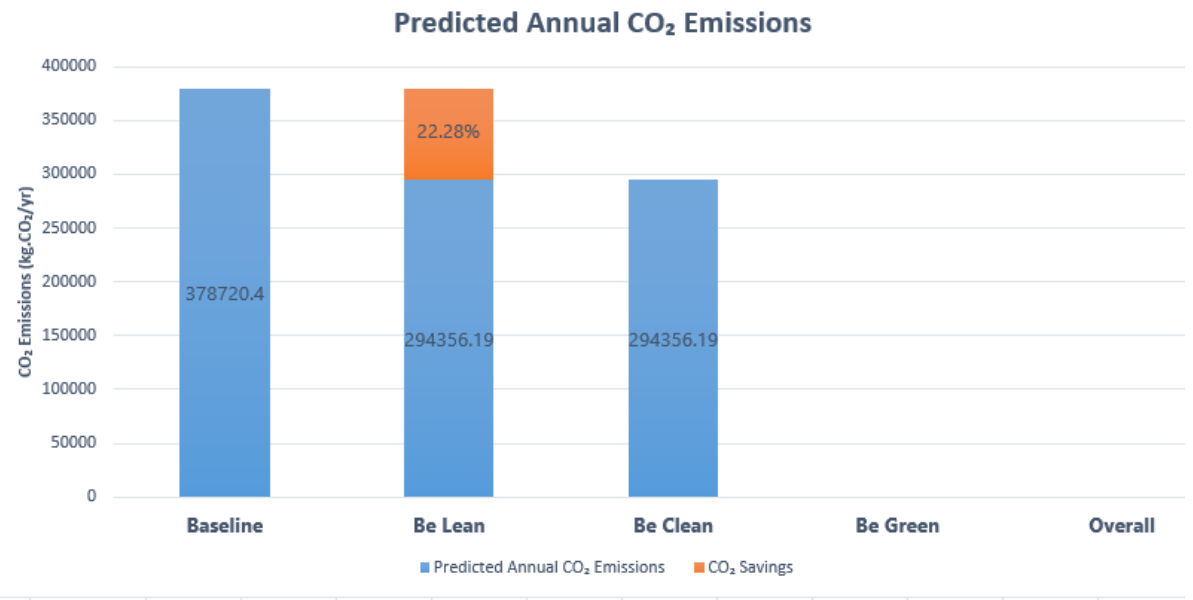


Figure 14: Be Clean Carbon Emissions Estimated SAP 10 Result



4.4 LOW & ZERO CARBON TECHNOLOGIES

4.4.1 General

Low and zero carbon (LZC) technologies are systems that generate energy with either zero or reduced CO2 emissions when compared against traditional energy generation methods.

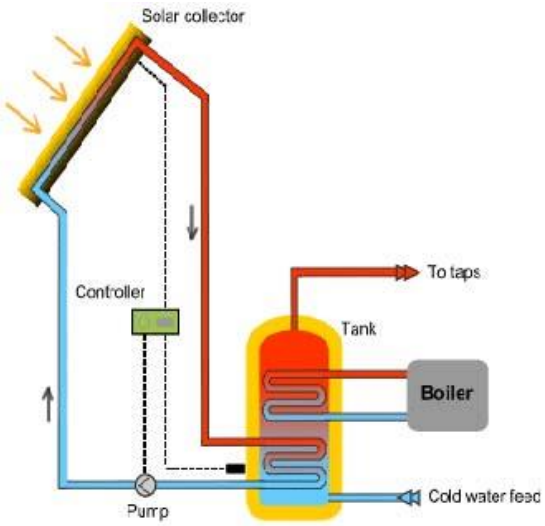
The alternative LZC technologies have been assessed in relation to the development and their viability assessed. Some of the LZCs are intrinsically unsuitable due to the development type and location whereas others are potentially viable.

4.4.2 Solar Water Heating

Solar thermal panels utilise the sun energy to generate hot water for use within the building. The panels are commonly provided in either flat plate or evacuated tube arrangements. The panels are ideally located facing south at an approximate 30° inclination angle in areas where they are not subjected to shade.

This system alone would not generate a large enough CO_2 reduction in proportion to other comparable technologies. This technology has also been discounted due to the inflated cost of installation with regards additional pipe runs, maintenance requirements and the significant roof area that would be required.

Figure 15: Solar Thermal Diagram



4.4.3 Wind Turbines

Wind turbines generate electrical energy derived from kinetic energy provided by the local wind resource. The performance of wind turbines depends greatly on the wind speed and turbulence that in turn is influenced by the terrain and installation height.

Figure 16: Typical Small Scale 6kW Wind Turbine



The use of wind turbines on the development will also have a significant visual impact on the city centre location and neighbouring buildings, as well as low frequency noise source and hence it is likely to meet opposition within the local area.

In very simplistic terms, space for such a large technology on this development site cannot be considered.

For the reasons detailed above wind turbines are not considered viable for the development.

4.4.4 Photovoltaic Cells (PV)

Photovoltaic (PV) panels utilise the sun's energy to generate electricity. The optimum location for PV panels is south facing at an approximate 30-45° inclination angle in areas where they are not subjected to shade.

Figure 17: PV Examples



PV technology has been discounted from this strategy due to limited roof space for installation, furthermore there is limited plant space to accommodate inverters. The requirements of Part L and the Manchester Core Strategy can be met through fabric efficiency and low carbon M&E design, PV is

therefore not required on this development and would be impractical to install given the nature of building as a tower block with limited roof area.

4.4.5 Source Heating and Cooling

The Air Source Heat Pumps can be linked with indoor units to heat and cool the space. These could be either ceiling mounted cassette units, wall mounted units or floor mounted units. This option therefore has good flexibility in terms of installation. The outdoor units can be located anywhere and are not dependant on orientation. They need to be externally mounted and in a local compound to be safe.

ASHP technology has been included within the design to provide heating and cooling to domestic and non-domestic areas. This technology will also service part of the non-domestic hot water demand. ASHP's benefit from a simple installation process and low maintenance. Furthermore, they are very efficient with respect to energy produced vs energy used, for every 3-4 units of energy produced only 1 unit of energy is used. This technology has been chosen for its excellent carbon performance which best addresses the requirements of Part L, the Manchester Core Strategy, and the RIBA 2030 Climate Challenge.

4.4.6 Biomass Boiler

Biomass is considered to be a renewable fuel source as the CO_2 absorbed during the growth period is assessed as being approximately equal to the CO_2 emitted during combustion and hence deemed "carbon neutral". Biomass for boilers is typically wood either in chip or pellet form.

Biomass boilers require fuel storage together with associated transportation and delivery to the store location.

Figure 18: Biomass Example



With the minimal plant areas available for a biomass generator combined with the logistics and increase in pollution from wood pellet deliveries/transportation, biomass generators have not been included in this Energy Strategy.

For the above reasons, the use of a biomass boiler plant is not considered viable for the development.

4.4.7 Fuel Cell

The fuel cell technology essentially converts chemical energy into both electrical and heat energy. The cell needs to be continually supplied with hydrogen (derived from either a piped or storage source) and oxygen (derived from air) that are combined and the chemical reaction produce electrical energy, heat energy and water vapour.

The fuel cell requires a hydrogen fuel source that can either be from a piped source (not currently available) or from stored gas. However, the more usual approach currently in the UK is to use natural gas in order to generate the hydrogen required to operate the fuel cell.

Fuel cells have various commercial and technical limitations. There is a high initial capital cost together with there being few established suppliers and a very limited specialist design, installation, and maintenance capabilities.

Certain fuel cell elements require regular replacement imposing a significant on-going cost implication. The fuel cells themselves are generally large, heavy and require fresh air ventilation.

Due to the initial capital cost, space requirements and on-going maintenance costs fuel cells are not considered viable for this development.

4.5 WATER

The development will be designed to reduce mains/potable water and include water efficient devices and equipment. This will comprise of efficient water fixtures (low flow taps and showers, dual flush WCs and low volume baths) to reduce potable water demand to <16 litres/person/day as per the requirement within Building Regulations.

As stated previously <16 litres/person/day is the 2020 target in the RIBA 2030 Climate Challenge and the next target 2025 is <13 litres/person/day, this surpasses the requirement of Part G and we will use our best endeavour to reach this target.

This will be done using low flow rate sanitaryware and the use of flow restrictors throughout the development.

An example of the flow rates and capacities that could potentially be used are as follows. Please note these are a guide at this stage and actual figures may differ at the time of construction. However, they will fall within the required level:

- WC – Dual Flush – 6/3 Litre Flush capacity
- Wash hand basin taps – 5 L/min
- Kitchen sink taps – 7L/min
- Shower – 7L/min

4.6 CHOSEN RENEWABLE SOLUTION

Following the above review of various LZC technology the chosen solution for this strategy is to utilise low carbon air source heat pumps to provide heating and cooling. This would be used in conjunction with the fabric efficiency improvements as described at the Be Lean stage which; at present can satisfy the required CO_2 reduction stated in the current Manchester Core Strategy 2012 without the inclusion of any additional renewable technology.

As such no additional CO_2 reduction can be observed at the Be Green stage.

Figure 19: Be Green Carbon Emissions SAP 2012 Results

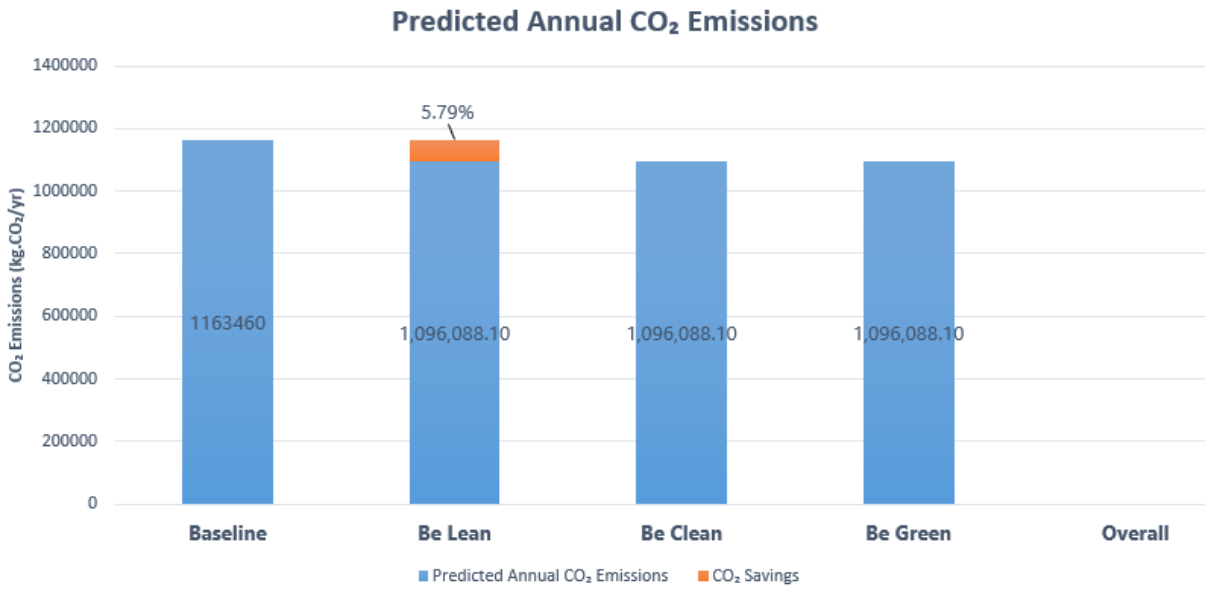
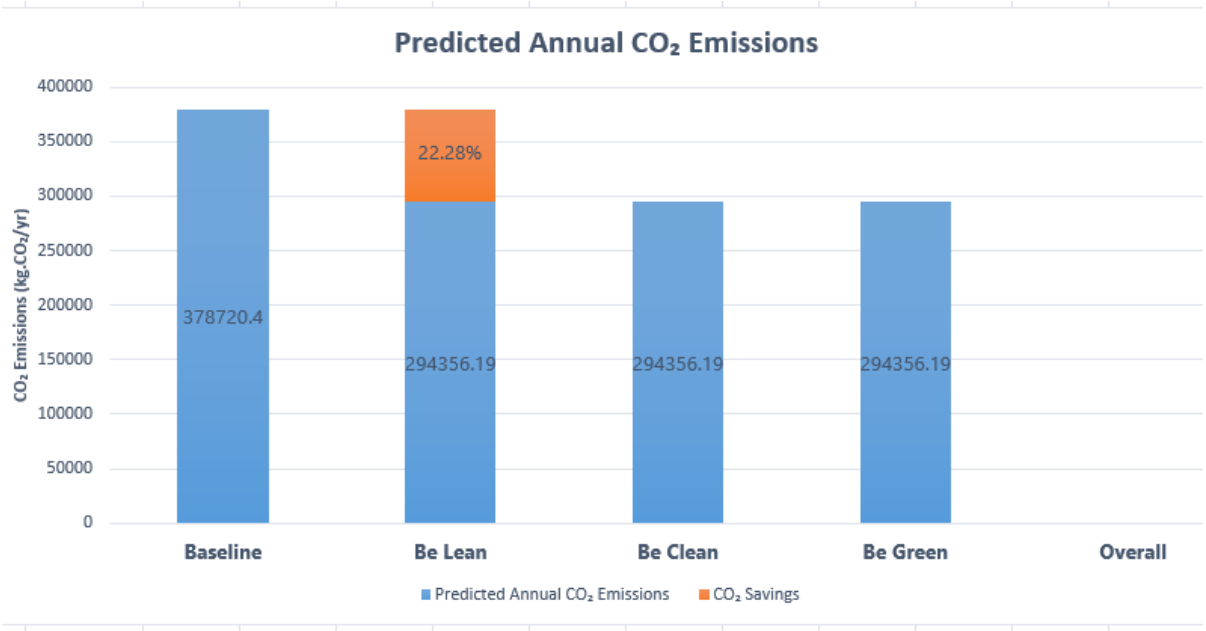


Figure 20: Be Green Carbon Emissions Estimated SAP 10 Results



4.7 PRIMARY ENERGY DEMAND & RIBA 2030 CLIMATE CHALLENGE

In order to calculate the energy demand for the entire development in kWh/yr the following is required.

The energy demand is made up of the following factors:

- Energy for space heating
- Energy for space cooling
- Energy for water heating
- Energy for ventilation
- Energy for lighting
- Energy generated by renewables

This is more specifically the Primary, Regulated Energy Demand given the fabric, considering the above factors.

The estimated SAP 10 primary energy demand results are displayed in the below table for typical units.

Table 14 Primary Energy Demand Typical Units

Unit	**Energy Demand** kWh/m^2/yr
Typical 1 bed unit Level 18	67.79 kWh/m^2/yr
Typical 2 bed unit Level 18	67.92 kWh/m^2/yr
Typical 2 bed unit Level 26	59.21 kWh/m^2/yr
Typical 2 bed unit Level 37	49.61 kWh/m^2/yr
Typical 3 bed unit Level 37	35.33 kWh/m^2/yr
Duplex Level 41	50.21 kWh/m^2/yr

This is a decent improvement on the current benchmark target of 105 kWh/m^2/yr and achieves the current RIBA 2030 Climate Challenge 2025 Target of < 70 kWh/m^2/yr. It is worthy of note however that RIBA intend to work with professional bodies to finalise their target metrics which may change as those discussions progress.

Figure 21: RIBA 2030 Climate Challenge Domestic Target Metrics

RIBA 2030 Climate Challenge target metrics for domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m^2/y	146 kWh/m^2 /y (Ofgem benchmark)	< 105 kWh/m^2/y	< 70 kWh/m^2/y	< 0 to 35 kWh/m^2/y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO$_2$e/m^2	1000 kgCO$_2$e/m^2 (M4i benchmark)	< 600 kgCO$_2$e/m^2	< 450 kgCO$_2$e/m^2	< 300 kgCO$_2$e/m^2	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

The Part L1A CO_2 reduction results also contribute to the embodied carbon targets with a 22.28% reduction in kg CO_2/m^2 being achieved through the use of fabric improvements alone as per the Be Lean stage of this report.

The non-domestic Operational Energy demand currently stands at around 82.48 kWh/m^2/yr which also achieves the 2025 target shown in the figure below.

Figure 22: RIBA 2030 Climate Challenge Non-Domestic Target Metrics

RIBA 2030 Climate Challenge target metrics for non-domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m^2/y	225 kWh/m^2/y DEC D rated (CIBSE TM46 benchmark)	< 170 kWh/m^2/y DEC C rating	< 110 kWh/m^2/y DEC B rating	< 0 to 55 kWh/m^2/y DEC A rating	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon $kgCO_2e/m^2$	1100 $kgCO_2e/m^2$ (M4i benchmark)	< 800 $kgCO_2e/m^2$	< 650 $kgCO_2e/m^2$	< 500 $kgCO_2e/m^2$	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day	>16 l/p/day (CIRA W11 benchmark)	< 16 l/p/day	< 13 l/p/day	< 10 l/p/day	CIBSE Guide G

As stated in section 2.5.2 The Embodied Carbon target is addressed only as far as our capacity as the Sustainability Consultant is concerned. In order to fully tackle the Whole Life Carbon of the building using Circular Economy Strategies; consideration of Embodied Carbon will be required by all parties involved with the design, construction and operation of the development, particularly parties with ISO14001 accreditation.

The RIBA 2030 Climate Challenge targets are ultimately non-binding however indicate good practice; we have therefore endeavoured to achieve the targets outlined.

5 CONCLUSIONS

The Energy Strategy for the proposed development St Michaels Manchester has adopted a hierarchical approach of using passive and low energy design technologies to reduce the baseline energy demand and hence CO_2 emissions followed by the feasibility of the application of low and zero carbon technologies as appropriate.

This is supported by the SAP/SBEM Calculations to provide compliance in England with the Building Regulations Part L, as current SAP 10 software has not fully released, reporting functionality is limited however reports can be produced as the software develops. The analysis has shown that by incorporating passive and low energy design measures, compliance with Part L 2012 is achieved. Furthermore, an estimated SAP 10 calculation shows that on-site CO_2 has been reduced over the baseline calculation by 22.28% therefore achieving the required 15% reduction over 2010 Building Regulations as stipulated in the Manchester Core Strategy.

This is achieved by incorporation of the following elements:

- Improved thermal transmittance U-valued as depicted.
- Air source heat pumps
- Mechanical Ventilation Heat Recovery systems with 88% heat recovery efficiency
- Highly efficient low carbon Air Source Heat Pumps
- Low building air leakage rate (5.0 m^3/h/m2 at a pressure differential of 50 Pa)
- 100% Low energy lighting through the buildings
- Low flow aerated showerheads and basin tap inserts to reduce water consumption
- Reducing mains/potable water via water efficient devices and equipment

A 'Fabric First' approach has been used in this strategy then, following the stages of the Energy Hierarchy, CHP and district heating has been assessed followed by a study of various low and zero carbon technologies. The graph below demonstrates the results for each stage of the Energy Hierarchy.

Figure 23: Overall CO_2 Emissions Reduction SAP 2012 Results

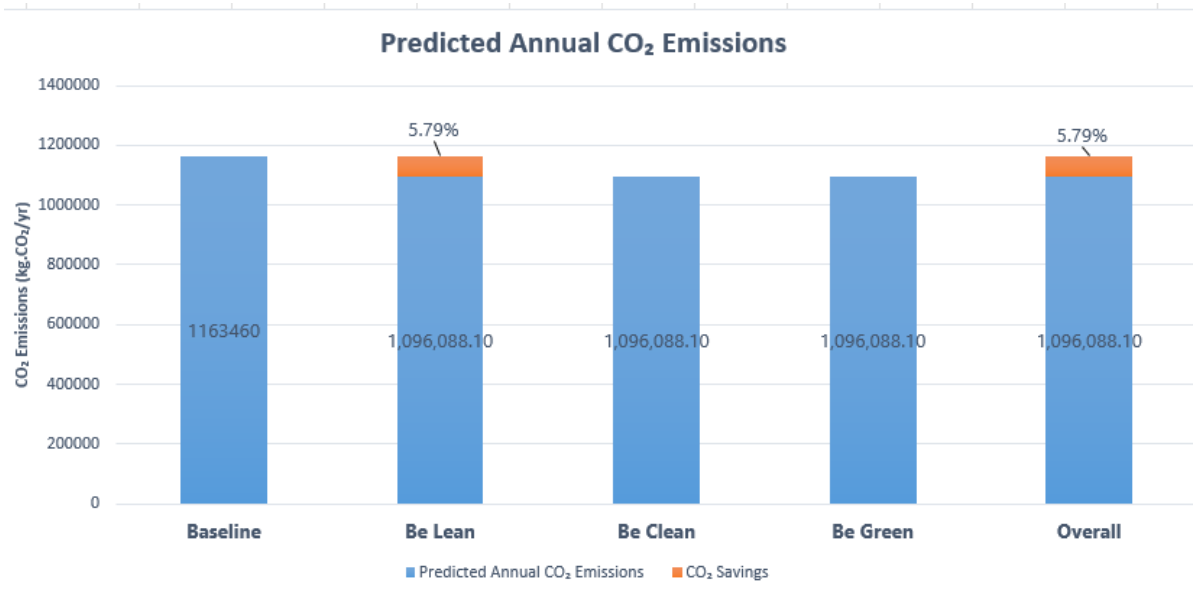
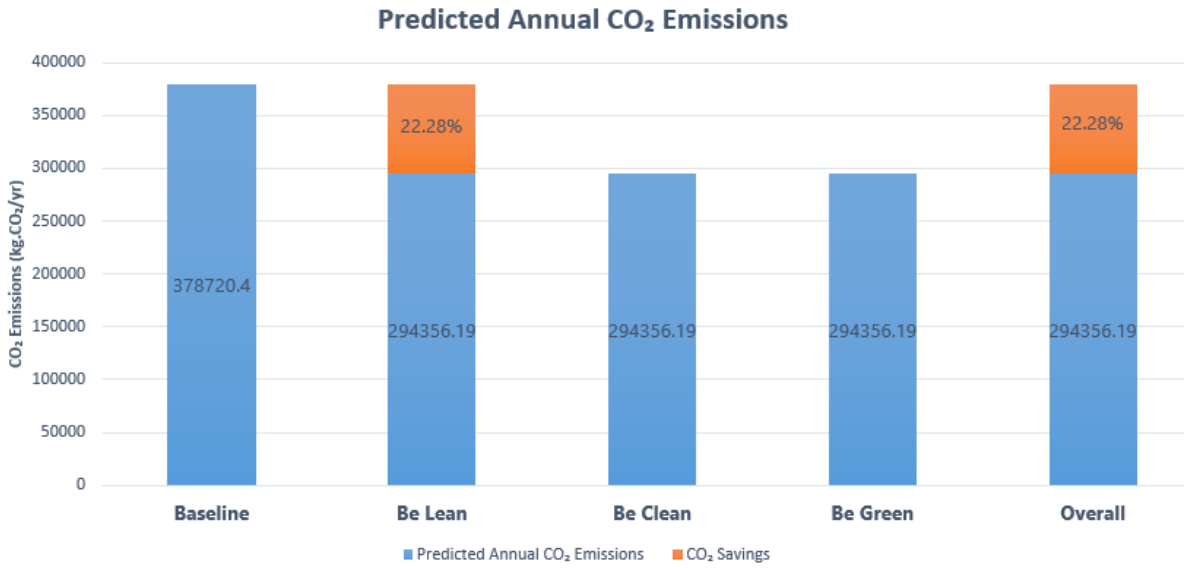


Figure 24: Overall CO_2 Emissions Reduction Estimated SAP 10 Results



A 22.28% overall reduction in CO_2 emissions can be observed. As stated previously, the Manchester Core Strategy requires a 15% improvement over Part L 2010 Building Regulations. These regulations have been superseded by 2013 and 2021 Building Regulations which collectively are a 37% betterment over 2010 Building Regulations by default. Therefore, by achieving a CO_2 reduction of 22.28% in the SAP 10 calculation graph above, this equates to a 59.28% improvement over 2010 Building Regulations and offers full compliance with the requirements of the Manchester Core Strategy.

Consideration has also been given to the RIBA 2030 Climate Challenge Targets with respect to domestic operational energy, embodied carbon and potable water use. Although RIBA plans on developing their targets further with UK professional bodies in order obtain concrete benchmarks; we have made every effort to reach the current baselines prescribed as we share RIBA's urgency and enthusiasm in addressing the current Environment and Climate Emergency.

To summarise, the SAP 10 estimated 22.28% reduction in CO_2 has been achieved using high-performance materials to improve the building fabric u-values, incorporating highly efficient air source heat pumps for heating/cooling and installing mechanical ventilation with heat recovery. Furthermore, low energy lighting will be used throughout, and low flow rate fixtures and fittings will be used to reduce water consumption. It is therefore the conclusion of this report that the requirements of Part L and the Manchester Core Strategy have been met whilst also supporting the RIBA 2030 Climate Challenge.

6 APPENDICES

Appendix A – SAP Reports

Appendix B – BRUKL Report

6 APPENDICES

Appendix A

SAP Reports (issued separately)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:37:06

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 71.67m²

Site Reference : P1785 St Michaels

Plot Reference: Level 17 Flat 17 01

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	27.39 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.45 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	46.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.17m²
Windows facing: West	6.79m²
Windows facing: North	11.32m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

DRAFT

10 Key features

Thermal bridging	0.028 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	71.67 m²	2.7 m

Living area:	39.54 m² (fraction 0.552)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.17	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.32	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.84	7.59	0.24	0	True	N/A
Floor to heated non-dom	71.67			0.09			N/A
Internal Elements							
INTERNAL WALLS	90.18						N/A
Party Elements							
PARTY WALLS	44.5						N/A
WALLS TO CORRIDOR	15.39						N/A

SAP Input

PARTY CEILING	71.67	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0278

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.73	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	44.35	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

DRAFT

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.69 (fraction 0.889)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.67	(1a) x	2.7	(2a) =	193.51	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		193.51	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.32	x 1/[1/(1)+ 0.04]		=	10.88			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Floor			71.67	x	0.09	=	6.4503			(28)
Walls	47.43	39.84	7.59	x	0.24	=	1.82			(29)
Total area of elements, m²			119.1							(31)
Party wall			44.5	x	0	=	0			(32)
Party wall			15.39	x	0	=	0			(32)
Party ceiling			71.67							(32b)
Internal wall **			90.18							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.58 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14657.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 49.89 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.8	24.47	24.13	22.43	22.09	20.39	20.39	20.06	21.07	22.09	22.77	23.45	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	74.69	74.35	74.01	72.32	71.98	70.28	70.28	69.94	70.96	71.98	72.66	73.34	

Average = Sum(39)$_{1...12}$ /12= 72.23 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.04	1.04	1.03	1.01	1	0.98	0.98	0.98	0.99	1	1.01	1.02	

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.49 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.34	93.8	90.26	86.72	83.18	79.64	79.64	83.18	86.72	90.26	93.8	97.34	

Total = Sum(44)$_{1...12}$ = 1061.9 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.35	126.25	130.28	113.58	108.99	94.05	87.15	100	101.2	117.94	128.74	139.8	

Total = Sum(45)$_{1...12}$ = 1392.32 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.65	18.94	19.54	17.04	16.35	14.11	13.07	15	15.18	17.69	19.31	20.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	174.3	153.3	160.23	142.56	138.93	123.03	117.09	129.95	130.18	147.88	157.72	169.75	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	174.3	153.3	160.23	142.56	138.93	123.03	117.09	129.95	130.18	147.88	157.72	169.75	

Output from water heater (annual)$_{1...12}$ — 1744.91 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	71.95	63.62	67.28	60.95	60.19	54.45	52.93	57.21	56.83	63.17	65.99	70.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.16	137.16	137.16	137.16	137.16	137.16	137.16	137.16	137.16	137.16	137.16	137.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	44.83	39.82	32.39	24.52	18.33	15.47	16.72	21.73	29.17	37.04	43.23	46.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	300.24	303.36	295.51	278.79	257.69	237.86	224.62	221.5	229.35	246.07	267.17	287	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51	51	51	51	51	51	51	51	51	51	51	51	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	(71)

Water heating gains (Table 5)

(72)m=	96.71	94.67	90.42	84.65	80.91	75.63	71.15	76.89	78.93	84.91	91.65	94.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	538.51	534.57	515.04	484.69	453.65	425.69	409.2	416.85	434.18	464.73	498.76	524.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.32	x	10.63	x	0.4	x	1	=	33.37	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.32	x	20.32	x	0.4	x	1	=	63.77	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.32	x	34.53	x	0.4	x	1	=	108.35	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.32	x	55.46	x	0.4	x	1	=	174.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.32	x	74.72	x	0.4	x	1	=	234.45	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.32	x	79.99	x	0.4	x	1	=	250.99	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.32	x	74.68	x	0.4	x	1	=	234.33	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.32	x	59.25	x	0.4	x	1	=	185.91	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.32	x	41.52	x	0.4	x	1	=	130.27	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.32	x	24.19	x	0.4	x	1	=	75.9	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.32	x	13.12	x	0.4	x	1	=	41.16	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.32	x	8.86	x	0.4	x	1	=	27.82	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.17	x	11.28	x	0.4	x	0.8	=	47.97	(81)
Northwest	0.9x	0.77	x	19.17	x	22.97	x	0.4	x	0.8	=	97.63	(81)
Northwest	0.9x	0.77	x	19.17	x	41.38	x	0.4	x	0.8	=	175.91	(81)
Northwest	0.9x	0.77	x	19.17	x	67.96	x	0.4	x	0.8	=	288.89	(81)
Northwest	0.9x	0.77	x	19.17	x	91.35	x	0.4	x	0.8	=	388.32	(81)

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Northwest	0.9x	0.77	x	19.17	x	97.38	x	0.4	x	0.8	=	413.99	(81)
Northwest	0.9x	0.77	x	19.17	x	91.1	x	0.4	x	0.8	=	387.28	(81)
Northwest	0.9x	0.77	x	19.17	x	72.63	x	0.4	x	0.8	=	308.75	(81)
Northwest	0.9x	0.77	x	19.17	x	50.42	x	0.4	x	0.8	=	214.35	(81)
Northwest	0.9x	0.77	x	19.17	x	28.07	x	0.4	x	0.8	=	119.32	(81)
Northwest	0.9x	0.77	x	19.17	x	14.2	x	0.4	x	0.8	=	60.35	(81)
Northwest	0.9x	0.77	x	19.17	x	9.21	x	0.4	x	0.8	=	39.17	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.58	243.81	420.5	664.17	872.75	922.62	866.16	702.28	503.75	293.04	154.12	101.79	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	662.09	778.38	935.54	1148.86	1326.4	1348.31	1275.36	1119.13	937.93	757.78	652.89	626.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.87	0.78	0.63	0.47	0.32	0.24	0.28	0.48	0.74	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.33	19.65	20.12	20.61	20.87	20.97	20.99	20.98	20.9	20.5	19.85	19.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.06	20.08	20.08	20.1	20.1	20.1	20.09	20.08	20.07	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.76	0.6	0.43	0.28	0.19	0.23	0.43	0.7	0.86	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.85	18.3	18.95	19.62	19.94	20.07	20.09	20.09	19.99	19.5	18.6	17.8	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.67	19.04	19.59	20.17	20.45	20.56	20.59	20.58	20.49	20.05	19.29	18.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	19.04	19.59	20.17	20.45	20.56	20.59	20.58	20.49	20.05	19.29	18.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.75	0.6	0.44	0.3	0.22	0.26	0.45	0.7	0.84	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	582.98	649.66	700.94	692.58	587.63	409.21	277.5	288.18	422.6	529.39	547.65	558.47	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1073.05	1051.54	969.18	814.68	629.82	419.21	280.26	292.64	453.57	680.08	885.67	1057.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	364.61	270.06	199.57	87.91	31.39	0	0	0	0	112.11	243.37	371.39	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1680.4	(98)
Space heating requirement in kWh/m²/year	23.45	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	660.66	520.09	531.57	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.95	0.96	0.95	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	624.78	501.65	504.36	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1504.07	1421.6	1237.7	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	633.09	684.44	545.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1863.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.89	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.06	121.21	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	413.92	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.78	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	364.61	270.06	199.57	87.91	31.39	0	0	0	0	112.11	243.37	371.39	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	214.48	158.86	117.39	51.71	18.46	0	0	0	0	65.95	143.16	218.46	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	988.47	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

174.3	153.3	160.23	142.56	138.93	123.03	117.09	129.95	130.18	147.88	157.72	169.75

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	174.3	153.3	160.23	142.56	138.93	123.03	117.09	129.95	130.18	147.88	157.72	169.75

Total = Sum(219a)$_{1...12}$ = 1744.91 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.18	28.3	22.56	0	0	0	0

Total = Sum(221)$_{6...8}$ = 77.04 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		988.47	
Water heating fuel used		1744.91	
Space cooling fuel used		77.04	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	182.96		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	182.96	(231)
Electricity for lighting		316.72	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3310.1	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	130.38	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	230.15	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	10.16	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	24.13	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	41.77	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		436.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.57	(257)
SAP rating (Section 12)		78.07	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	513.02	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	905.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1418.63	(265)
Space cooling	(221) x		0.519	=	39.98	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	94.96	(267)
Electricity for lighting	(232) x		0.519	=	164.38	(268)
Total CO2, kg/year		sum of (265)…(271) =			1717.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			23.97	(273)
EI rating (section 14)					80	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	3034.61	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5356.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8391.49	(265)
Space cooling	(221) x		3.07	=	236.5	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	561.7	(267)
Electricity for lighting	(232) x		0	=	972.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10162.01	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			141.79	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.67	(1a) x	2.7	(2a) =	193.51	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		193.51	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.41 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			8.62	x1/[1/(1.5)+ 0.04] =	12.2			(27)
Windows Type 2			3.05	x1/[1/(1.5)+ 0.04] =	4.32			(27)
Windows Type 3			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 4			1.15	x1/[1/(1.5)+ 0.04] =	1.63			(27)
Floor			71.67	x 0.13 =	9.3171			(28)
Walls	47.43	17.91	29.52	x 0.18 =	5.31			(29)
Total area of elements, m²			119.1					(31)
Party wall			44.5	x 0 =	0			(32)
Party wall			15.39	x 0 =	0			(32)
Party ceiling			71.67					(32b)
Internal wall **			90.18					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14964.95 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.2 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.18 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.08	37.84	37.61	36.51	36.3	35.34	35.34	35.17	35.71	36.3	36.72	37.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.26	81.02	80.79	79.69	79.48	78.52	78.52	78.35	78.89	79.48	79.9	80.33	

Average = Sum(39)$_{1...12}$ /12= 79.69 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.13	1.13	1.13	1.11	1.11	1.1	1.1	1.09	1.1	1.11	1.11	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.49 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.34	93.8	90.26	86.72	83.18	79.64	79.64	83.18	86.72	90.26	93.8	97.34	

Total = Sum(44)$_{1...12}$ = 1061.9 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.35	126.25	130.28	113.58	108.99	94.05	87.15	100	101.2	117.94	128.74	139.8	

Total = Sum(45)$_{1...12}$ = 1392.32 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.65	18.94	19.54	17.04	16.35	14.11	13.07	15	15.18	17.69	19.31	20.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.45	171.5	180.37	162.06	159.08	142.52	137.24	150.09	149.67	168.03	177.21	189.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.45	171.5	180.37	162.06	159.08	142.52	137.24	150.09	149.67	168.03	177.21	189.89	

Output from water heater (annual)$_{1...12}$ — 1982.11 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.07	78.17	83.39	76.55	76.31	70.05	69.05	73.32	72.43	79.29	81.59	86.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	114.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.93	15.93	12.95	9.81	7.33	6.19	6.69	8.69	11.67	14.81	17.29	18.43	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.16	203.25	197.99	186.79	172.66	159.37	150.49	148.41	153.67	164.86	179	192.29	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	-91.44	(71)

Water heating gains (Table 5)

(72)m=	118.38	116.33	112.09	106.32	102.57	97.29	92.81	98.55	100.6	106.57	113.31	116.34	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	397.76	395.8	383.32	363.2	342.84	323.14	310.28	315.94	326.22	346.54	369.89	387.35	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.09	x	10.63	x	0.63	x	0.7	=	16.54	(74)
North	0.9x	0.77	x	1.15	x	10.63	x	0.63	x	0.7	=	3.74	(74)
North	0.9x	0.77	x	5.09	x	20.32	x	0.63	x	0.7	=	31.61	(74)
North	0.9x	0.77	x	1.15	x	20.32	x	0.63	x	0.7	=	7.14	(74)
North	0.9x	0.77	x	5.09	x	34.53	x	0.63	x	0.7	=	53.71	(74)
North	0.9x	0.77	x	1.15	x	34.53	x	0.63	x	0.7	=	12.14	(74)
North	0.9x	0.77	x	5.09	x	55.46	x	0.63	x	0.7	=	86.28	(74)
North	0.9x	0.77	x	1.15	x	55.46	x	0.63	x	0.7	=	19.49	(74)
North	0.9x	0.77	x	5.09	x	74.72	x	0.63	x	0.7	=	116.23	(74)
North	0.9x	0.77	x	1.15	x	74.72	x	0.63	x	0.7	=	26.26	(74)
North	0.9x	0.77	x	5.09	x	79.99	x	0.63	x	0.7	=	124.42	(74)
North	0.9x	0.77	x	1.15	x	79.99	x	0.63	x	0.7	=	28.11	(74)
North	0.9x	0.77	x	5.09	x	74.68	x	0.63	x	0.7	=	116.16	(74)
North	0.9x	0.77	x	1.15	x	74.68	x	0.63	x	0.7	=	26.25	(74)
North	0.9x	0.77	x	5.09	x	59.25	x	0.63	x	0.7	=	92.16	(74)
North	0.9x	0.77	x	1.15	x	59.25	x	0.63	x	0.7	=	20.82	(74)
North	0.9x	0.77	x	5.09	x	41.52	x	0.63	x	0.7	=	64.58	(74)
North	0.9x	0.77	x	1.15	x	41.52	x	0.63	x	0.7	=	14.59	(74)
North	0.9x	0.77	x	5.09	x	24.19	x	0.63	x	0.7	=	37.63	(74)
North	0.9x	0.77	x	1.15	x	24.19	x	0.63	x	0.7	=	8.5	(74)
North	0.9x	0.77	x	5.09	x	13.12	x	0.63	x	0.7	=	20.41	(74)
North	0.9x	0.77	x	1.15	x	13.12	x	0.63	x	0.7	=	4.61	(74)
North	0.9x	0.77	x	5.09	x	8.86	x	0.63	x	0.7	=	13.79	(74)
North	0.9x	0.77	x	1.15	x	8.86	x	0.63	x	0.7	=	3.12	(74)
West	0.9x	0.77	x	3.05	x	19.64	x	0.63	x	0.7	=	18.31	(80)
West	0.9x	0.77	x	3.05	x	38.42	x	0.63	x	0.7	=	35.81	(80)
West	0.9x	0.77	x	3.05	x	63.27	x	0.63	x	0.7	=	58.98	(80)
West	0.9x	0.77	x	3.05	x	92.28	x	0.63	x	0.7	=	86.02	(80)
West	0.9x	0.77	x	3.05	x	113.09	x	0.63	x	0.7	=	105.42	(80)
West	0.9x	0.77	x	3.05	x	115.77	x	0.63	x	0.7	=	107.91	(80)
West	0.9x	0.77	x	3.05	x	110.22	x	0.63	x	0.7	=	102.74	(80)
West	0.9x	0.77	x	3.05	x	94.68	x	0.63	x	0.7	=	88.25	(80)
West	0.9x	0.77	x	3.05	x	73.59	x	0.63	x	0.7	=	68.59	(80)
West	0.9x	0.77	x	3.05	x	45.59	x	0.63	x	0.7	=	42.49	(80)
West	0.9x	0.77	x	3.05	x	24.49	x	0.63	x	0.7	=	22.83	(80)
West	0.9x	0.77	x	3.05	x	16.15	x	0.63	x	0.7	=	15.05	(80)
Northwest	0.9x	0.77	x	8.62	x	11.28	x	0.63	x	0.7	=	29.72	(81)
Northwest	0.9x	0.77	x	8.62	x	22.97	x	0.63	x	0.7	=	60.5	(81)
Northwest	0.9x	0.77	x	8.62	x	41.38	x	0.63	x	0.7	=	109.01	(81)
Northwest	0.9x	0.77	x	8.62	x	67.96	x	0.63	x	0.7	=	179.02	(81)
Northwest	0.9x	0.77	x	8.62	x	91.35	x	0.63	x	0.7	=	240.64	(81)

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Northwest	0.9x	0.77	x	8.62	x	97.38	x	0.63	x	0.7	=	256.55	(81)
Northwest	0.9x	0.77	x	8.62	x	91.1	x	0.63	x	0.7	=	240	(81)
Northwest	0.9x	0.77	x	8.62	x	72.63	x	0.63	x	0.7	=	191.33	(81)
Northwest	0.9x	0.77	x	8.62	x	50.42	x	0.63	x	0.7	=	132.83	(81)
Northwest	0.9x	0.77	x	8.62	x	28.07	x	0.63	x	0.7	=	73.94	(81)
Northwest	0.9x	0.77	x	8.62	x	14.2	x	0.63	x	0.7	=	37.4	(81)
Northwest	0.9x	0.77	x	8.62	x	9.21	x	0.63	x	0.7	=	24.27	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.31	135.07	233.84	370.81	488.54	516.99	485.14	392.56	280.59	162.56	85.24	56.23	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.07	530.87	617.16	734.01	831.39	840.14	795.42	708.5	606.81	509.1	455.14	443.58	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.58	0.43	0.5	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.98	20.26	20.63	20.89	20.98	21	20.99	20.91	20.56	20.13	19.81	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.98	19.98	19.99	19.99	20	20	20.01	20	19.99	19.99	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.9	0.73	0.5	0.34	0.4	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.64	19.04	19.57	19.89	19.99	20	20	19.93	19.49	18.87	18.39	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.19	19.38	19.71	20.15	20.44	20.54	20.55	20.55	20.48	20.08	19.57	19.17	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.19	19.38	19.71	20.15	20.44	20.54	20.55	20.55	20.48	20.08	19.57	19.17	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.91	0.75	0.54	0.39	0.45	0.75	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	463.82	525.71	600.71	667.17	627.35	456.45	308.89	322.1	455.87	485.25	450.73	441.9	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1210.32	1172.97	1067.27	896.6	694.6	466.27	310.27	325.1	502.95	753.33	996.08	1202.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	555.4	434.96	347.13	165.19	50.03	0	0	0	0	199.45	392.65	566.01	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2710.81	(98)
Space heating requirement in kWh/m²/year	37.82	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
555.4	434.96	347.13	165.19	50.03	0	0	0	0	199.45	392.65	566.01	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
594.01	465.2	371.26	176.67	53.51	0	0	0	0	213.32	419.95	605.36	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2899.27 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.45	171.5	180.37	162.06	159.08	142.52	137.24	150.09	149.67	168.03	177.21	189.89

Efficiency of water heater 79.8 (216)

(217)m=	87.46	87.19	86.53	84.86	82.12	79.8	79.8	79.8	79.8	85.27	86.88	87.55	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.33	196.68	208.45	190.96	193.71	178.6	171.98	188.09	187.56	197.05	203.98	216.89	

Total = Sum(219a)$_{1...12}$ = 2356.27 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2899.27
Water heating fuel used		2356.27
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		316.72 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5647.26 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	626.24	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	508.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1135.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.38	(268)
Total CO2, kg/year	sum of (265)…(271) =			1338.5	(272)

TER = 27.39 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	255.43	**(P1)**
Transmission heat loss coefficient:	49.9	
Summer heat loss coefficient:	305.32	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.17	89.66	0.4	0.8	0.9	445.48	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.32	73.49	0.4	1	0.9	269.54	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	996.32	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	425.69	409.2	416.85	
Total summer gains	1520.25	1405.53	1211.56	**(P5)**
Summer gain/loss ratio	4.98	4.6	3.97	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.98	22.3	21.57	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:36:58

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 71.68m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 17 Flat 17 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	27.49 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	46.8 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.17m²
Windows facing: East	6.79m²
Windows facing: North	11.32m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.031 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	71.68 m²	2.7 m

Living area:	39.54 m² (fraction 0.552)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.17	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.32	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.84	7.59	0.24	0	True	N/A
Floor to heated non-dom	71.68			0.09			N/A
Internal Elements							
INT WALLS	90.18						N/A
Party Elements							
PARTY WALLS	44.5						N/A
WALLS TO CORRIDOR	15.39						N/A

SAP Input

PARTY CEILING	71.68	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0308

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	44.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.69 (fraction 0.889)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.68	(1a) x	2.7	(2a) =	193.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.68	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		193.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.32	x 1/[1/(1)+ 0.04]		=	10.88			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Floor			71.68	x	0.09	=	6.4512			(28)
Walls	47.43	39.84	7.59	x	0.24	=	1.82			(29)
Total area of elements, m²			119.11							(31)
Party wall			44.5	x	0	=	0			(32)
Party wall			15.39	x	0	=	0			(32)
Party ceiling			71.68							(32b)
Internal wall **			90.18							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.58 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14659.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.25 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.81	24.47	24.13	22.43	22.09	20.4	20.4	20.06	21.08	22.09	22.77	23.45	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	75.06	74.72	74.38	72.69	72.35	70.65	70.65	70.31	71.33	72.35	73.03	73.7	

Average = Sum(39)$_{1...12}$ /12= 72.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.05	1.04	1.04	1.01	1.01	0.99	0.99	0.98	1	1.01	1.02	1.03	

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.35	93.81	90.27	86.73	83.19	79.65	79.65	83.19	86.73	90.27	93.81	97.35	

Total = Sum(44)$_{1...12}$ = 1061.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.36	126.26	130.29	113.59	108.99	94.05	87.15	100.01	101.2	117.94	128.74	139.81	

Total = Sum(45)$_{1...12}$ = 1392.41 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.65	18.94	19.54	17.04	16.35	14.11	13.07	15	15.18	17.69	19.31	20.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	174.31	153.31	160.24	142.57	138.94	123.03	117.1	129.96	130.18	147.89	157.72	169.75	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	174.31	153.31	160.24	142.57	138.94	123.03	117.1	129.96	130.18	147.89	157.72	169.75	

Output from water heater (annual)$_{1...12}$ — 1745 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	71.96	63.62	67.28	60.95	60.2	54.46	52.94	57.21	56.83	63.17	65.99	70.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.17	137.17	137.17	137.17	137.17	137.17	137.17	137.17	137.17	137.17	137.17	137.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	44.84	39.83	32.39	24.52	18.33	15.47	16.72	21.73	29.17	37.04	43.23	46.09	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	300.28	303.39	295.54	278.83	257.72	237.89	224.64	221.53	229.38	246.1	267.2	287.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51	51	51	51	51	51	51	51	51	51	51	51	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	(71)

Water heating gains (Table 5)

(72)m=	96.72	94.67	90.43	84.66	80.91	75.63	71.15	76.9	78.94	84.91	91.65	94.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	538.56	534.62	515.09	484.73	453.69	425.73	409.24	416.88	434.21	464.77	498.81	524.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.32	x	10.63	x	0.4	x	1	=	33.37	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.32	x	20.32	x	0.4	x	1	=	63.77	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.32	x	34.53	x	0.4	x	1	=	108.35	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.32	x	55.46	x	0.4	x	1	=	174.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.32	x	74.72	x	0.4	x	1	=	234.45	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.32	x	79.99	x	0.4	x	1	=	250.99	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.32	x	74.68	x	0.4	x	1	=	234.33	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.32	x	59.25	x	0.4	x	1	=	185.91	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.32	x	41.52	x	0.4	x	1	=	130.27	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.32	x	24.19	x	0.4	x	1	=	75.9	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.32	x	13.12	x	0.4	x	1	=	41.16	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.32	x	8.86	x	0.4	x	1	=	27.82	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.17	x	11.28	x	0.4	x	0.8	=	47.97	(75)
Northeast	0.9x	0.77	x	19.17	x	22.97	x	0.4	x	0.8	=	97.63	(75)
Northeast	0.9x	0.77	x	19.17	x	41.38	x	0.4	x	0.8	=	175.91	(75)
Northeast	0.9x	0.77	x	19.17	x	67.96	x	0.4	x	0.8	=	288.89	(75)
Northeast	0.9x	0.77	x	19.17	x	91.35	x	0.4	x	0.8	=	388.32	(75)
Northeast	0.9x	0.77	x	19.17	x	97.38	x	0.4	x	0.8	=	413.99	(75)
Northeast	0.9x	0.77	x	19.17	x	91.1	x	0.4	x	0.8	=	387.28	(75)
Northeast	0.9x	0.77	x	19.17	x	72.63	x	0.4	x	0.8	=	308.75	(75)
Northeast	0.9x	0.77	x	19.17	x	50.42	x	0.4	x	0.8	=	214.35	(75)
Northeast	0.9x	0.77	x	19.17	x	28.07	x	0.4	x	0.8	=	119.32	(75)
Northeast	0.9x	0.77	x	19.17	x	14.2	x	0.4	x	0.8	=	60.35	(75)
Northeast	0.9x	0.77	x	19.17	x	9.21	x	0.4	x	0.8	=	39.17	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.58	243.81	420.5	664.17	872.75	922.62	866.16	702.28	503.75	293.04	154.12	101.79	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	662.14	778.43	935.59	1148.9	1326.44	1348.34	1275.4	1119.17	937.97	757.82	652.93	626.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.87	0.79	0.63	0.47	0.33	0.24	0.28	0.48	0.74	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.32	19.64	20.11	20.6	20.86	20.97	20.99	20.98	20.89	20.49	19.84	19.28	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.05	20.05	20.07	20.08	20.1	20.1	20.1	20.09	20.08	20.07	20.06	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.76	0.6	0.43	0.28	0.19	0.23	0.43	0.7	0.86	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.83	18.28	18.93	19.61	19.93	20.07	20.09	20.09	19.99	19.48	18.58	17.78	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.65	19.03	19.58	20.16	20.45	20.56	20.59	20.58	20.49	20.04	19.28	18.61	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.65	19.03	19.58	20.16	20.45	20.56	20.59	20.58	20.49	20.04	19.28	18.61	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.84	0.75	0.6	0.44	0.3	0.22	0.26	0.45	0.7	0.84	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	583.2	650.06	701.73	694.11	589.59	410.93	278.73	289.42	423.99	530.2	547.99	558.66	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1077.19	1055.64	973.07	818.21	632.7	421.21	281.57	294.01	455.64	682.92	889.2	1061.8	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	367.52	272.55	201.87	89.35	32.07	0	0	0	0	113.62	245.67	374.34	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1697	(98)
Space heating requirement in kWh/m²/year	23.67	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	664.12	522.82	534.37	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.96	0.95	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	627.33	503.87	506.45	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1504.11	1421.63	1237.74	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	631.28	682.82	544.07	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1858.18	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.89	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.23	151.68	120.86	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	412.76	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.76	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	367.52	272.55	201.87	89.35	32.07	0	0	0	0	113.62	245.67	374.34	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	216.19	160.32	118.75	52.56	18.87	0	0	0	0	66.84	144.51	220.2	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	998.24	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	174.31	153.31	160.24	142.57	138.94	123.03	117.1	129.96	130.18	147.89	157.72	169.75

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	174.31	153.31	160.24	142.57	138.94	123.03	117.1	129.96	130.18	147.89	157.72	169.75

Total = Sum(219a)$_{1...12}$ = 1745 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.1	28.23	22.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 76.82 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		998.24	
Water heating fuel used		1745	
Space cooling fuel used		76.82	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	204.95		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	204.95	(231)
Electricity for lighting		316.75	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3341.76	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	131.67	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	230.17	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.13	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	27.03	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	41.78	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				440.78	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.59	(257)
SAP rating (Section 12)		77.87	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	518.09	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	905.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1423.74	(265)
Space cooling	(221)	x	0.519	=	39.87	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	106.37	(267)
Electricity for lighting	(232)	x	0.519	=	164.39	(268)
Total CO2, kg/year		sum of (265)…(271) =			1734.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.2	(273)
EI rating (section 14)					80	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	3064.59	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5357.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8421.74	(265)
Space cooling	(221)	x	3.07	=	235.84	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	629.19	(267)
Electricity for lighting	(232)	x	0	=	972.43	(268)
'Total Primary Energy		sum of (265)…(271) =			10259.2	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			143.12	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.68	(1a) x	2.7	(2a) =	193.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.68	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		193.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.41 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			8.62	x1/[1/(1.5)+ 0.04] =	12.2			(27)
Windows Type 2			3.05	x1/[1/(1.5)+ 0.04] =	4.32			(27)
Windows Type 3			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 4			1.15	x1/[1/(1.5)+ 0.04] =	1.63			(27)
Floor			71.68	x 0.13 =	9.318399			(28)
Walls	47.43	17.91	29.52	x 0.18 =	5.31			(29)
Total area of elements, m²			119.11					(31)
Party wall			44.5	x 0 =	0			(32)
Party wall			15.39	x 0 =	0			(32)
Party ceiling			71.68					(32b)
Internal wall **			90.18					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14966.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.55 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.09	37.85	37.61	36.51	36.31	35.35	35.35	35.17	35.72	36.31	36.72	37.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.63	81.39	81.16	80.06	79.85	78.89	78.89	78.72	79.26	79.85	80.27	80.7	

Average = Sum(39)$_{1...12}$ /12= 80.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.13	1.12	1.11	1.1	1.1	1.1	1.11	1.11	1.12	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.5 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.35	93.81	90.27	86.73	83.19	79.65	79.65	83.19	86.73	90.27	93.81	97.35	

Total = Sum(44)$_{1...12}$ = 1061.97 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.36	126.26	130.29	113.59	108.99	94.05	87.15	100.01	101.2	117.94	128.74	139.81	

Total = Sum(45)$_{1...12}$ = 1392.41 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.65	18.94	19.54	17.04	16.35	14.11	13.07	15	15.18	17.69	19.31	20.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.45	171.51	180.38	162.07	159.08	142.53	137.24	150.1	149.68	168.04	177.22	189.9	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.45	171.51	180.38	162.07	159.08	142.53	137.24	150.1	149.68	168.04	177.22	189.9	

Output from water heater (annual)$_{1...12}$ — 1982.2 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.07	78.18	83.39	76.55	76.31	70.05	69.05	73.33	72.43	79.29	81.59	86.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.31	114.31	114.31	114.31	114.31	114.31	114.31	114.31	114.31	114.31	114.31	114.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.94	15.93	12.96	9.81	7.33	6.19	6.69	8.69	11.67	14.82	17.29	18.43	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.19	203.27	198.01	186.81	172.68	159.39	150.51	148.42	153.68	164.88	179.02	192.31	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	-91.45	(71)

Water heating gains (Table 5)

(72)m=	118.38	116.33	112.09	106.32	102.57	97.3	92.81	98.56	100.6	106.57	113.32	116.34	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	397.79	395.83	383.35	363.23	342.87	323.17	310.3	315.97	326.24	346.56	369.92	387.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	5.09	x	10.63	x	0.63	x	0.7	=	16.54	(74)
North	0.9x	0.77	x	1.15	x	10.63	x	0.63	x	0.7	=	3.74	(74)
North	0.9x	0.77	x	5.09	x	20.32	x	0.63	x	0.7	=	31.61	(74)
North	0.9x	0.77	x	1.15	x	20.32	x	0.63	x	0.7	=	7.14	(74)
North	0.9x	0.77	x	5.09	x	34.53	x	0.63	x	0.7	=	53.71	(74)
North	0.9x	0.77	x	1.15	x	34.53	x	0.63	x	0.7	=	12.14	(74)
North	0.9x	0.77	x	5.09	x	55.46	x	0.63	x	0.7	=	86.28	(74)
North	0.9x	0.77	x	1.15	x	55.46	x	0.63	x	0.7	=	19.49	(74)
North	0.9x	0.77	x	5.09	x	74.72	x	0.63	x	0.7	=	116.23	(74)
North	0.9x	0.77	x	1.15	x	74.72	x	0.63	x	0.7	=	26.26	(74)
North	0.9x	0.77	x	5.09	x	79.99	x	0.63	x	0.7	=	124.42	(74)
North	0.9x	0.77	x	1.15	x	79.99	x	0.63	x	0.7	=	28.11	(74)
North	0.9x	0.77	x	5.09	x	74.68	x	0.63	x	0.7	=	116.16	(74)
North	0.9x	0.77	x	1.15	x	74.68	x	0.63	x	0.7	=	26.25	(74)
North	0.9x	0.77	x	5.09	x	59.25	x	0.63	x	0.7	=	92.16	(74)
North	0.9x	0.77	x	1.15	x	59.25	x	0.63	x	0.7	=	20.82	(74)
North	0.9x	0.77	x	5.09	x	41.52	x	0.63	x	0.7	=	64.58	(74)
North	0.9x	0.77	x	1.15	x	41.52	x	0.63	x	0.7	=	14.59	(74)
North	0.9x	0.77	x	5.09	x	24.19	x	0.63	x	0.7	=	37.63	(74)
North	0.9x	0.77	x	1.15	x	24.19	x	0.63	x	0.7	=	8.5	(74)
North	0.9x	0.77	x	5.09	x	13.12	x	0.63	x	0.7	=	20.41	(74)
North	0.9x	0.77	x	1.15	x	13.12	x	0.63	x	0.7	=	4.61	(74)
North	0.9x	0.77	x	5.09	x	8.86	x	0.63	x	0.7	=	13.79	(74)
North	0.9x	0.77	x	1.15	x	8.86	x	0.63	x	0.7	=	3.12	(74)
Northeast	0.9x	0.77	x	8.62	x	11.28	x	0.63	x	0.7	=	29.72	(75)
Northeast	0.9x	0.77	x	8.62	x	22.97	x	0.63	x	0.7	=	60.5	(75)
Northeast	0.9x	0.77	x	8.62	x	41.38	x	0.63	x	0.7	=	109.01	(75)
Northeast	0.9x	0.77	x	8.62	x	67.96	x	0.63	x	0.7	=	179.02	(75)
Northeast	0.9x	0.77	x	8.62	x	91.35	x	0.63	x	0.7	=	240.64	(75)
Northeast	0.9x	0.77	x	8.62	x	97.38	x	0.63	x	0.7	=	256.55	(75)
Northeast	0.9x	0.77	x	8.62	x	91.1	x	0.63	x	0.7	=	240	(75)
Northeast	0.9x	0.77	x	8.62	x	72.63	x	0.63	x	0.7	=	191.33	(75)
Northeast	0.9x	0.77	x	8.62	x	50.42	x	0.63	x	0.7	=	132.83	(75)
Northeast	0.9x	0.77	x	8.62	x	28.07	x	0.63	x	0.7	=	73.94	(75)
Northeast	0.9x	0.77	x	8.62	x	14.2	x	0.63	x	0.7	=	37.4	(75)
Northeast	0.9x	0.77	x	8.62	x	9.21	x	0.63	x	0.7	=	24.27	(75)
East	0.9x	0.77	x	3.05	x	19.64	x	0.63	x	0.7	=	18.31	(76)
East	0.9x	0.77	x	3.05	x	38.42	x	0.63	x	0.7	=	35.81	(76)
East	0.9x	0.77	x	3.05	x	63.27	x	0.63	x	0.7	=	58.98	(76)
East	0.9x	0.77	x	3.05	x	92.28	x	0.63	x	0.7	=	86.02	(76)
East	0.9x	0.77	x	3.05	x	113.09	x	0.63	x	0.7	=	105.42	(76)

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East	0.9x	0.77	x	3.05	x	115.77	x	0.63	x	0.7	=	107.91	(76)
East	0.9x	0.77	x	3.05	x	110.22	x	0.63	x	0.7	=	102.74	(76)
East	0.9x	0.77	x	3.05	x	94.68	x	0.63	x	0.7	=	88.25	(76)
East	0.9x	0.77	x	3.05	x	73.59	x	0.63	x	0.7	=	68.59	(76)
East	0.9x	0.77	x	3.05	x	45.59	x	0.63	x	0.7	=	42.49	(76)
East	0.9x	0.77	x	3.05	x	24.49	x	0.63	x	0.7	=	22.83	(76)
East	0.9x	0.77	x	3.05	x	16.15	x	0.63	x	0.7	=	15.05	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.31	135.07	233.84	370.81	488.54	516.99	485.14	392.56	280.59	162.56	85.24	56.23	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	466.1	530.9	617.19	734.04	831.41	840.16	795.45	708.53	606.84	509.13	455.17	443.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.58	0.43	0.5	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.97	20.25	20.62	20.88	20.98	21	20.99	20.91	20.55	20.13	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.99	19.99	20	20	20	20	19.99	19.98	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.73	0.5	0.34	0.4	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.62	19.03	19.56	19.88	19.99	20	20	19.93	19.48	18.86	18.38	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.18	19.37	19.7	20.14	20.43	20.54	20.55	20.55	20.47	20.07	19.56	19.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.18	19.37	19.7	20.14	20.43	20.54	20.55	20.55	20.47	20.07	19.56	19.16	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.91	0.76	0.55	0.39	0.46	0.75	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	463.85	525.75	600.82	667.69	628.75	458.13	310.13	323.36	456.89	485.43	450.77	441.93	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1215.05	1177.57	1071.46	900.2	697.49	468.28	311.58	326.48	505.03	756.31	1000.02	1207.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	558.89	438.02	350.16	167.41	51.14	0	0	0	0	201.54	395.46	569.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2732.16	(98)
Space heating requirement in kWh/m²/year	38.12	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	558.89	438.02	350.16	167.41	51.14	0	0	0	0	201.54	395.46	569.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	597.75	468.47	374.5	179.05	54.7	0	0	0	0	215.55	422.95	609.13	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2922.09 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.45	171.51	180.38	162.07	159.08	142.53	137.24	150.1	149.68	168.04	177.22	189.9	

Efficiency of water heater 79.8 (216)

(217)m=	87.47	87.21	86.55	84.9	82.16	79.8	79.8	79.8	79.8	85.3	86.89	87.56	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.3	196.66	208.4	190.89	193.62	178.61	171.99	188.1	187.57	196.99	203.95	216.87	

Total = Sum(219a)$_{1...12}$ = 2355.94 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2922.09
Water heating fuel used		2355.94
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		316.75 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5669.79 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	631.17	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	508.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1140.06	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.39	(268)
Total CO2, kg/year	sum of (265)…(271) =			1343.38	(272)

TER = 27.49 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	255.47	**(P1)**
Transmission heat loss coefficient:	50.3	
Summer heat loss coefficient:	305.72	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.17	89.66	0.4	0.8	0.9	445.48	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.32	73.49	0.4	1	0.9	269.54	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	996.32	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	425.73	409.24	416.88	
Total summer gains	1520.29	1405.56	1211.59	**(P5)**
Summer gain/loss ratio	4.97	4.6	3.96	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.97	22.3	21.56	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:36:50

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 38.02m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 17 Flat 17 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	31.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	28.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.83 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Thermal bridging	0.039 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 17 Flat 17 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	38.02 m²	2.7 m

Living area:	18.76 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Floor to heated non-dom	38.02			0.09			N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.23						N/A
PARTY CEILING	38.02						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0391

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.02	(1a) x	2.7	(2a) =	102.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.02	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x	1/[1/(1)+ 0.04]	=	15.22			(27)
Floor			38.02	x	0.09	=	3.4218			(28)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			59.14							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.23	x	0	=	0			(32)
Party ceiling			38.02							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8203.04 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.35	12.18	12.02	11.2	11.04	10.22	10.22	10.05	10.54	11.04	11.36	11.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	34.57	34.41	34.25	33.43	33.26	32.44	32.44	32.28	32.77	33.26	33.59	33.92	

Average = Sum(39)$_{1...12}$ /12= 33.38 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.9	0.88	0.87	0.85	0.85	0.85	0.86	0.87	0.88	0.89

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.38 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	73.01	70.36	67.7	65.05	62.39	59.74	59.74	62.39	65.05	67.7	70.36	73.01

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.51 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.28	94.7	97.72	85.2	81.75	70.54	65.37	75.01	75.91	88.46	96.56	104.86

Total = Sum(45)$_{1...12}$ = 1044.35 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.48	15.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.99	112.51	117.44	104.28	101.46	89.62	85.08	94.73	94.99	108.18	115.64	124.58	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.99	112.51	117.44	104.28	101.46	89.62	85.08	94.73	94.99	108.18	115.64	124.58	

Output from water heater (annual)$_{1...12}$ 1276.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.77	45.73	48.27	43.59	42.95	38.72	37.51	40.71	40.5	45.19	47.37	50.64	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.98	23.08	18.77	14.21	10.62	8.97	9.69	12.59	16.9	21.46	25.05	26.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	174.01	175.82	171.27	161.58	149.35	137.86	130.18	128.38	132.93	142.61	154.84	166.33	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	(71)

Water heating gains (Table 5)

(72)m=	69.59	68.06	64.87	60.54	57.73	53.78	50.41	54.72	56.25	60.73	65.79	68.06	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	341.16	338.53	326.49	307.91	289.29	272.18	261.86	267.27	277.66	296.39	317.27	332.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.77	419.16	471.75	546.47	609.95	614.05	581.67	522.23	454.66	394.92	367.1	365.03	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.88	0.85	0.77	0.63	0.48	0.33	0.24	0.28	0.47	0.7	0.84	0.89	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.76	19.98	20.32	20.7	20.9	20.98	20.99	20.99	20.93	20.65	20.18	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.21	20.2	20.19	20.18	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.87	0.83	0.75	0.6	0.44	0.29	0.2	0.23	0.42	0.67	0.82	0.88	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.53	18.83	19.31	19.83	20.08	20.19	20.2	20.2	20.13	19.78	19.13	18.5	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.4	19.81	20.26	20.48	20.58	20.59	20.59	20.53	20.21	19.65	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.14	19.4	19.81	20.26	20.48	20.58	20.59	20.59	20.53	20.21	19.65	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.85	0.81	0.74	0.61	0.45	0.31	0.22	0.26	0.44	0.67	0.81	0.86	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	324.02	341.2	349.23	331.44	276.03	190.42	128.67	133.92	200.15	265.39	295.61	314.37	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	512.94	498.81	455.73	379.6	292.16	193.88	129.54	135.29	210.6	319.59	421.4	505.81	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	140.55	105.92	79.24	34.68	12	0	0	0	0	40.32	90.57	142.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	645.7	(98)
Space heating requirement in kWh/m²/year	16.98	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	304.95	240.06	245.3	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.95	0.97	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	290.8	233.13	235.24	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.76	635.66	565.27	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	274.29	299.49	245.54	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	819.32	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	58.51	63.88	52.38	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	174.77	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.6	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	140.55	105.92	79.24	34.68	12	0	0	0	0	40.32	90.57	142.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	82.68	62.3	46.61	20.4	7.06	0	0	0	0	23.72	53.28	83.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	379.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

127.99	112.51	117.44	104.28	101.46	89.62	85.08	94.73	94.99	108.18	115.64	124.58	

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.99	112.51	117.44	104.28	101.46	89.62	85.08	94.73	94.99	108.18	115.64	124.58	

Total = Sum(219a)$_{1...12}$ = 1276.49 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	10.89	11.89	9.75	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 32.53 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		379.83	
Water heating fuel used		1276.49	
Space cooling fuel used		32.53	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.71		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.71	(231)
Electricity for lighting		183.56	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1981.11	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	50.1	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.37	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.29	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.34	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.21	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				261.31	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.56	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	197.13	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =				859.63	(265)
Space cooling	(221) x		0.519	=	16.88	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.42	(267)
Electricity for lighting	(232) x		0.519	=	95.27	(268)
Total CO2, kg/year		sum of (265)…(271) =			1028.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			27.04	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1166.07	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3918.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5084.88	(265)
Space cooling	(221) x		3.07	=	99.86	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.73	(267)
Electricity for lighting	(232) x		0	=	563.53	(268)
'Total Primary Energy		sum of (265)…(271) =			6081.99	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			159.97	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.02	(1a) x	2.7	(2a) =	102.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.02	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.19 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.44 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.51	x 1/[1/(1.5)+ 0.04] =	13.46			(27)
Floor			38.02	x 0.13 =	4.9426			(28)
Walls	21.12	9.51	11.61	x 0.18 =	2.09			(29)
Total area of elements, m²			59.14					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.23	x 0 =	0			(32)
Party ceiling			38.02					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8291.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.21	20.08	19.96	19.37	19.26	18.75	18.75	18.66	18.95	19.26	19.49	19.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	43.01	42.89	42.76	42.18	42.07	41.56	41.56	41.46	41.75	42.07	42.29	42.52	

Average = Sum(39)$_{1...12}$ /12= 42.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.09	1.09	1.09	1.1	1.11	1.11	1.12

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.38 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.01	70.36	67.7	65.05	62.39	59.74	59.74	62.39	65.05	67.7	70.36	73.01

Total = Sum(44)$_{1...12}$ = 796.51 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.28	94.7	97.72	85.2	81.75	70.54	65.37	75.01	75.91	88.46	96.56	104.86

Total = Sum(45)$_{1...12}$ = 1044.35 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.48	15.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.23	136.2	143.67	129.67	127.7	115.01	111.32	120.96	120.38	134.41	141.03	150.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.23	136.2	143.67	129.67	127.7	115.01	111.32	120.96	120.38	134.41	141.03	150.81	

Output from water heater (annual)$_{1...12}$ 1585.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.76	64.69	69.25	63.9	63.94	59.03	58.5	61.7	60.81	66.18	67.68	71.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.23	7.51	5.68	4.25	3.59	3.88	5.04	6.76	8.59	10.02	10.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.59	117.8	114.75	108.26	100.07	92.37	87.22	86.01	89.06	95.55	103.74	111.44	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	(71)

Water heating gains (Table 5)

(72)m=	97.8	96.27	93.08	88.76	85.94	81.99	78.62	82.93	84.46	88.95	94	96.27	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	271.1	269.62	261.66	249.02	236.58	224.26	216.04	220.3	226.61	239.4	254.09	264.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.51	x	11.28	x	0.63	x	0.7	=	32.79	(75)
Northeast 0.9x	0.77	x	9.51	x	22.97	x	0.63	x	0.7	=	66.75	(75)
Northeast 0.9x	0.77	x	9.51	x	41.38	x	0.63	x	0.7	=	120.26	(75)
Northeast 0.9x	0.77	x	9.51	x	67.96	x	0.63	x	0.7	=	197.51	(75)
Northeast 0.9x	0.77	x	9.51	x	91.35	x	0.63	x	0.7	=	265.49	(75)

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Northeast 0.9x	0.77	x	9.51	x	97.38	x	0.63	x	0.7	=	283.04	(75)
Northeast 0.9x	0.77	x	9.51	x	91.1	x	0.63	x	0.7	=	264.77	(75)
Northeast 0.9x	0.77	x	9.51	x	72.63	x	0.63	x	0.7	=	211.08	(75)
Northeast 0.9x	0.77	x	9.51	x	50.42	x	0.63	x	0.7	=	146.54	(75)
Northeast 0.9x	0.77	x	9.51	x	28.07	x	0.63	x	0.7	=	81.57	(75)
Northeast 0.9x	0.77	x	9.51	x	14.2	x	0.63	x	0.7	=	41.26	(75)
Northeast 0.9x	0.77	x	9.51	x	9.21	x	0.63	x	0.7	=	26.78	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.79	66.75	120.26	197.51	265.49	283.04	264.77	211.08	146.54	81.57	41.26	26.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.9	336.37	381.92	446.52	502.07	507.3	480.82	431.39	373.15	320.98	295.35	291.5	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.89	0.72	0.52	0.38	0.44	0.71	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.11	20.38	20.72	20.92	20.99	21	21	20.95	20.66	20.26	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.86	0.66	0.44	0.29	0.35	0.63	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.62	18.83	19.21	19.68	19.93	20	20.01	20.01	19.96	19.62	19.06	18.6	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.28	19.46	19.79	20.19	20.42	20.49	20.5	20.5	20.45	20.13	19.65	19.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.28	19.46	19.79	20.19	20.42	20.49	20.5	20.5	20.45	20.13	19.65	19.26	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.34	0.39	0.67	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	300.37	329.62	363.93	385.71	344.18	241.88	161.53	169.02	250.44	293.97	288.82	288.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	644.55	624.5	568.16	476.3	366.86	244.69	161.89	169.8	265.1	401.06	530.84	640.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	256.07	198.16	151.94	65.23	16.87	0	0	0	0	79.68	174.25	261.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1203.88	(98)
Space heating requirement in kWh/m²/year	31.66	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
256.07	198.16	151.94	65.23	16.87	0	0	0	0	79.68	174.25	261.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
273.87	211.94	162.51	69.76	18.05	0	0	0	0	85.21	186.37	279.87	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1287.57	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	154.23	136.2	143.67	129.67	127.7	115.01	111.32	120.96	120.38	134.41	141.03	150.81	
Efficiency of water heater												79.8	(216)
(217)m=	86.16	85.81	84.96	83.09	80.92	79.8	79.8	79.8	79.8	83.47	85.38	86.27	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	179.01	158.72	169.1	156.06	157.82	144.13	139.5	151.58	150.85	161.03	165.18	174.81	
Total = Sum(219a)$_{1...12}$ =												1907.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1287.57	
Water heating fuel used		1907.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.56	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3453.91	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	278.12	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	412.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			690.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.27	(268)
Total CO2, kg/year	sum of (265)…(271) =			824.39	(272)

TER = 31.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.5	**(P1)**
Transmission heat loss coefficient:	22.2	
Summer heat loss coefficient:	157.73	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.18	261.86	267.27	
Total summer gains	677.76	629.73	555.78	**(P5)**
Summer gain/loss ratio	4.3	3.99	3.52	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.3	21.69	21.12	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:36:41

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.62m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 17 Flat 17 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.27 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.00 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.023 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.62 m²	2.7 m

Living area:	30.73 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Floor to heated non-dom	50.62			0.09			N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0235

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.12	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.98	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43 (fraction 0.849)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Floor			50.62	x	0.09	=	4.5558			(28)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			73.01							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9359.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.71 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 25.55 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.44	16.22	16	14.91	14.69	13.6	13.6	13.38	14.04	14.69	15.13	15.57	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	41.99	41.77	41.55	40.46	40.24	39.15	39.15	38.93	39.58	40.24	40.68	41.11	

Average = Sum(39)$_{1...12}$ /12= 40.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.79	0.77	0.77	0.77	0.78	0.79	0.8	0.81	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Output from water heater (annual)$_{1...12}$ | 1408.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.33	49.72	52.38	47.18	46.39	41.69	40.26	43.87	43.7	48.91	51.43	55.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.17	29.46	23.96	18.14	13.56	11.45	12.37	16.08	21.58	27.4	31.98	34.1	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.16	224.46	218.65	206.28	190.67	176	166.2	163.89	169.7	182.07	197.68	212.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	75.71	73.98	70.4	65.52	62.36	57.9	54.11	58.96	60.69	65.74	71.43	73.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.17	409.04	394.14	371.07	347.72	326.47	313.8	320.06	333.1	356.33	382.23	401.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.68	609.39	697.47	783.63	834.47	818.19	784.52	735.69	675.12	586.36	516.09	493.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.8	0.71	0.57	0.43	0.3	0.22	0.24	0.39	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.27	20.56	20.82	20.94	20.99	21	21	20.97	20.8	20.39	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.24	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.78	0.68	0.54	0.4	0.27	0.18	0.2	0.35	0.59	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.28	19.69	20.04	20.19	20.26	20.27	20.28	20.24	20.02	19.48	18.88	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.57	19.88	20.22	20.52	20.65	20.7	20.71	20.71	20.68	20.49	20.03	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.57	19.88	20.22	20.52	20.65	20.7	20.71	20.71	20.68	20.49	20.03	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.77	0.68	0.55	0.42	0.29	0.2	0.23	0.38	0.6	0.77	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	435.99	471.88	476.32	431.18	347.23	236.33	160.42	167.06	253.94	354.75	399.94	419.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	641.31	625.64	570	469.94	360.03	238.93	161.01	167.91	260.52	398.03	526.02	630.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	152.76	103.33	69.7	27.91	9.52	0	0	0	0	32.2	90.77	156.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 643.17 (98)

Space heating requirement in kWh/m²/year 12.71 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	367.98	289.69	295.86	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	357.37	284.93	289.63	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.21	863.99	805.86	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	391.57	430.82	384.08	0	0	0	0	

Total = Sum(104) = 1206.46 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	83.16	91.49	81.57	0	0	0	0

Total = Sum(107) = 256.21 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.06 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	152.76	103.33	69.7	27.91	9.52	0	0	0	0	32.2	90.77	156.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	89.86	60.78	41	16.42	5.6	0	0	0	0	18.94	53.4	92.35	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 378.34 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Total = Sum(219a)$_{1...12}$ = 1408.62 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.48	17.03	15.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.69 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		378.34
Water heating fuel used		1408.62
Space cooling fuel used		47.69

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.73	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.73	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2213.72	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	49.9	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	185.8	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	6.29	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	19.09	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	30.91	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				291.99	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.28	(257)
SAP rating (Section 12)	82.11	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	196.36	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	731.07	(264)
Space and water heating	(261) + (262) + (263) + (264) =				927.43	(265)
Space cooling	(221)	x	0.519	=	24.75	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	75.12	(267)

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Electricity for lighting	(232) x	0.519	=	121.62	(268)
Total CO2, kg/year	sum of (265)…(271) =			1148.92	(272)
CO2 emissions per m²	(272) ÷ (4) =			22.7	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1161.5	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4324.47	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5485.96	(265)
Space cooling	(221) x		3.07	=	146.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	444.33	(267)
Electricity for lighting	(232) x		0	=	719.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6796.12	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				134.26	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Floor			50.62	x 0.13 =	6.5806			(28)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			73.01					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9451.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.61 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 27.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(38)m=	26.01	25.88	25.74	25.13	25.01	24.47	24.47	24.37	24.68	25.01	25.24	25.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	53.86	53.72	53.59	52.97	52.86	52.32	52.32	52.22	52.53	52.86	53.09	53.34	

Average = Sum(39)$_{1...12}$ /12= 52.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

TER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	

Output from water heater (annual)$_{1...12}$ | 1722.95 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.69	69.01	73.73	67.84	67.75	62.35	61.61	65.23	64.36	70.26	72.1	76.41	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.27	11.79	9.58	7.26	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.84	150.39	146.5	138.21	127.75	117.92	111.35	109.81	113.7	121.99	132.45	142.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	104.42	102.69	99.1	94.23	91.06	86.6	82.82	87.67	89.39	94.44	100.14	102.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.16	316.49	306.81	291.32	275.86	260.73	250.74	255.54	263.35	279.02	297.01	310.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.54	496.62	579.8	662.95	714.55	703.97	675.02	630.02	571.29	485.9	417.3	392.76	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.83	0.66	0.47	0.34	0.38	0.61	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.28	20.56	20.83	20.96	20.99	21	21	20.98	20.78	20.38	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.04	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.6	0.4	0.27	0.3	0.54	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.12	19.51	19.86	20.01	20.05	20.06	20.06	20.04	19.82	19.26	18.78	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.59	19.83	20.15	20.45	20.59	20.62	20.63	20.63	20.61	20.4	19.94	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.59	19.83	20.15	20.45	20.59	20.62	20.63	20.63	20.61	20.4	19.94	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.81	0.63	0.44	0.31	0.35	0.58	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	411.1	481.42	535.11	536.01	452.04	313.03	210.51	220.35	333.24	422.88	405.43	388.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	823.49	801.91	731.29	611.79	469.7	315.18	210.76	220.81	341.86	518.05	681.71	818.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	306.81	215.37	145.96	54.56	13.13	0	0	0	0	70.81	198.92	319.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1325.29 (98)

Space heating requirement in kWh/m²/year 26.18 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	306.81	215.37	145.96	54.56	13.13	0	0	0	0	70.81	198.92	319.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	328.14	230.34	156.1	58.35	14.05	0	0	0	0	75.73	212.75	341.96	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1417.42 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54

Efficiency of water heater 79.8 (216)

(217)m=	86.4	85.8	84.63	82.52	80.63	79.8	79.8	79.8	79.8	83	85.5	86.56

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.91	173.19	184.92	170.73	171.78	155.87	150.44	164.05	163.44	175.97	179.75	190.09

Total = Sum(219a)$_{1...12}$ = 2075.15 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1417.42	
Water heating fuel used		2075.15	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3801.91	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	306.16	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	448.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				754.4	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.62	(268)
Total CO2, kg/year		sum of (265)…(271) =			914.95	(272)

TER = 26.27 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.41	**(P1)**
Transmission heat loss coefficient:	25.5	
Summer heat loss coefficient:	205.96	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.47	313.8	320.06	
Total summer gains	909.83	855.26	790.39	**(P5)**
Summer gain/loss ratio	4.42	4.15	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.42	21.85	21.44	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:36:33

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.62m²
Site Reference : P1785 St Michaels
Plot Reference: Level 17 Flat 17 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	27.27 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.52 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	44.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.87 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.026 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.62 m²	2.7 m

Living area:	30.73 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Floor to heated non-dom	50.62			0.09			N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0258

	Length	Psi-value		
[Approved]	12.77	0.05	E4	Jamb
[Approved]	11.75	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.98	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.27 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Floor			50.62	x	0.09	=	4.5558			(28)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			73.01							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9315.34 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 25.36 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.44	16.22	16	14.91	14.69	13.6	13.6	13.38	14.04	14.69	15.13	15.57	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	41.8	41.58	41.36	40.27	40.05	38.96	38.96	38.74	39.39	40.05	40.49	40.92	

Average = Sum(39)$_{1...12}$ /12= 40.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.82	0.82	0.8	0.79	0.77	0.77	0.77	0.78	0.79	0.8	0.81	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Output from water heater (annual)$_{1...12}$ | 1408.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.33	49.72	52.38	47.18	46.39	41.69	40.26	43.87	43.7	48.91	51.43	55.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.17	29.46	23.96	18.14	13.56	11.45	12.37	16.08	21.58	27.4	31.98	34.1	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.16	224.46	218.65	206.28	190.67	176	166.2	163.89	169.7	182.07	197.68	212.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	75.71	73.98	70.4	65.52	62.36	57.9	54.11	58.96	60.69	65.74	71.43	73.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.17	409.04	394.14	371.07	347.72	326.47	313.8	320.06	333.1	356.33	382.23	401.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	485.84	552.71	631.74	722.36	784.51	776.87	741.23	682.65	610.7	526.89	473.96	462.26

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.88	0.83	0.75	0.6	0.45	0.32	0.23	0.26	0.43	0.67	0.83	0.89	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.17	20.49	20.79	20.93	20.99	21	20.99	20.96	20.75	20.32	19.9	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.24	20.26	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.87	0.82	0.72	0.57	0.42	0.28	0.19	0.22	0.39	0.64	0.81	0.88	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	19.15	19.59	20.01	20.19	20.27	20.28	20.28	20.23	19.97	19.38	18.78	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.77	20.13	20.48	20.64	20.7	20.71	20.71	20.67	20.44	19.95	19.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.77	20.13	20.48	20.64	20.7	20.71	20.71	20.67	20.44	19.95	19.46	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.85	0.81	0.72	0.58	0.44	0.3	0.22	0.24	0.41	0.65	0.8	0.87	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	415.24	445.37	455.12	421.02	343.37	234.82	159.58	166.08	250.56	341.6	380.45	400.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	634.78	618.11	563.9	466.39	358.02	237.76	160.26	167.11	258.97	394.18	520.27	624.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	163.34	116.08	80.93	32.66	10.9	0	0	0	0	39.12	100.67	166.48	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 710.19 (98)

Space heating requirement in kWh/m²/year 14.03 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	366.2	288.29	294.42	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	354.18	282.79	286.82	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	852.91	813.39	743.86	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	359.09	394.76	340.04	0	0	0	0	

Total = Sum(104) = 1093.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	76.74	84.36	72.67	0	0	0	0

Total = Sum(107)$_{6...8}$ = 233.77 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.62 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	163.34	116.08	80.93	32.66	10.9	0	0	0	0	39.12	100.67	166.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	96.08	68.28	47.61	19.21	6.41	0	0	0	0	23.01	59.22	97.93	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 417.76 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Total = Sum(219a)$_{1...12}$ = 1408.62 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.28	15.7	13.52	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 43.51 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		417.76
Water heating fuel used		1408.62
Space cooling fuel used		43.51

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.73	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.73	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2248.96	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	55.1	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.8	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	5.74	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.09	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.91	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					296.64	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)	81.82	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	216.82	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.07	(264)
Space and water heating	(261) + (262) + (263) + (264) =					947.89	(265)
Space cooling	(221)	x		0.519	=	22.58	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.12	(267)

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Electricity for lighting	(232) x	0.519	=	121.62	(268)
Total CO2, kg/year	sum of (265)…(271) =			1167.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			23.06	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1282.52	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4324.47	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5606.98	(265)
Space cooling	(221) x		3.07	=	133.57	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	444.33	(267)
Electricity for lighting	(232) x		0	=	719.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6904.32	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				136.4	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.87	x1/[1/(1.5)+ 0.04] =	13.97			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Floor			50.62	x 0.13 =	6.5806			(28)
Walls	22.39	12.66	9.73	x 0.18 =	1.75			(29)
Total area of elements, m²			73.01					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9315.34 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 28.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.01	25.88	25.74	25.13	25.01	24.47	24.47	24.37	24.68	25.01	25.24	25.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.04	53.91	53.78	53.16	53.04	52.5	52.5	52.4	52.71	53.04	53.28	53.52	

Average = Sum(39)$_{1...12}$ /12= 53.16 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.04	1.05	1.05	1.06	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

TER WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	

Output from water heater (annual)$_{1...12}$ | 1722.95 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.69	69.01	73.73	67.84	67.75	62.35	61.61	65.23	64.36	70.26	72.1	76.41	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.27	11.79	9.58	7.26	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.84	150.39	146.5	138.21	127.75	117.92	111.35	109.81	113.7	121.99	132.45	142.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	104.42	102.69	99.1	94.23	91.06	86.6	82.82	87.67	89.39	94.44	100.14	102.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.16	316.49	306.81	291.32	275.86	260.73	250.74	255.54	263.35	279.02	297.01	310.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.87	x	19.64	x	0.63	x	0.7	=	59.24	(76)
East	0.9x	0.77	x	9.87	x	38.42	x	0.63	x	0.7	=	115.89	(76)
East	0.9x	0.77	x	9.87	x	63.27	x	0.63	x	0.7	=	190.86	(76)
East	0.9x	0.77	x	9.87	x	92.28	x	0.63	x	0.7	=	278.35	(76)
East	0.9x	0.77	x	9.87	x	113.09	x	0.63	x	0.7	=	341.13	(76)
East	0.9x	0.77	x	9.87	x	115.77	x	0.63	x	0.7	=	349.21	(76)
East	0.9x	0.77	x	9.87	x	110.22	x	0.63	x	0.7	=	332.46	(76)
East	0.9x	0.77	x	9.87	x	94.68	x	0.63	x	0.7	=	285.58	(76)
East	0.9x	0.77	x	9.87	x	73.59	x	0.63	x	0.7	=	221.97	(76)
East	0.9x	0.77	x	9.87	x	45.59	x	0.63	x	0.7	=	137.52	(76)
East	0.9x	0.77	x	9.87	x	24.49	x	0.63	x	0.7	=	73.87	(76)
East	0.9x	0.77	x	9.87	x	16.15	x	0.63	x	0.7	=	48.72	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.31	133.22	220.3	325.65	404.84	417.41	396.14	336.1	257.37	158.14	85.05	56.28

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.47	449.71	527.11	616.97	680.7	678.14	646.88	591.63	520.73	437.16	382.06	366.52

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.99	0.96	0.86	0.68	0.49	0.36	0.41	0.67	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.2	20.48	20.79	20.95	20.99	21	21	20.97	20.72	20.31	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.83	0.63	0.42	0.28	0.32	0.59	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.74	19	19.4	19.81	20	20.05	20.05	20.05	20.03	19.74	19.17	18.7	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.52	19.73	20.05	20.41	20.58	20.62	20.63	20.63	20.6	20.34	19.86	19.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.52	19.73	20.05	20.41	20.58	20.62	20.63	20.63	20.6	20.34	19.86	19.48	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.84	0.66	0.46	0.33	0.37	0.63	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.8	440.38	497.66	518.4	449.05	313.54	211.11	220.86	329.66	395.73	374.42	363.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	822.48	799.27	728.9	611.59	470.78	316.17	211.43	221.5	342.5	516.4	680	818.01	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	327.12	241.17	172.04	67.1	16.17	0	0	0	0	89.78	220.02	337.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1471.32 (98)

Space heating requirement in kWh/m²/year 29.07 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	327.12	241.17	172.04	67.1	16.17	0	0	0	0	89.78	220.02	337.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	349.86	257.94	184	71.76	17.29	0	0	0	0	96.02	235.31	361.42	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1573.61 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54

Efficiency of water heater 79.8 (216)

(217)m=	86.56	86.1	85.07	82.96	80.8	79.8	79.8	79.8	79.8	83.56	85.77	86.69

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.54	172.59	183.97	169.82	171.42	155.87	150.44	164.05	163.44	174.8	179.19	189.79

Total = Sum(219a)$_{1...12}$ = 2069.93 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1573.61	
Water heating fuel used		2069.93	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3952.88	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	339.9	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	447.11	(264)
Space and water heating	(261) + (262) + (263) + (264) =				787	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.62	(268)
Total CO2, kg/year		sum of (265)…(271) =			947.55	(272)

TER = 27.27 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.41	**(P1)**
Transmission heat loss coefficient:	25.4	
Summer heat loss coefficient:	205.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.47	313.8	320.06	
Total summer gains	860.81	805.46	730.37	**(P5)**
Summer gain/loss ratio	4.18	3.91	3.55	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.18	21.61	21.15	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:36:25

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 38.03m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 17 Flat 17 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	28.83 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.06 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	39.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.81m²
Ventilation rate:	4.00

10 Key features

Thermal bridging	0.039 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 17 Flat 17 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	38.03 m²	2.7 m

Living area:	18.97 m² (fraction 0.499)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.81	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.81	4.31	0.24	0	True	N/A
Floor to heated non-dom	38.03			0.09			N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.52						N/A
WALLS TO CORRIDOR	15.84						N/A
PARTY CEILING	38.03						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.039

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.58	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.71 (fraction 0.860)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.03	(1a) x	2.7	(2a) =	102.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.03	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.81	x	1/[1/(1)+ 0.04]	=	16.16			(27)
Floor			38.03	x	0.09	=	3.4227			(28)
Walls	21.12	16.81	4.31	x	0.24	=	1.03			(29)
Total area of elements, m²			59.15							(31)
Party wall			36.52	x	0	=	0			(32)
Party wall			15.84	x	0	=	0			(32)
Party ceiling			38.03							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7082.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.93 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.35	12.19	12.02	11.2	11.04	10.22	10.22	10.05	10.55	11.04	11.37	11.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	35.28	35.12	34.95	34.13	33.97	33.15	33.15	32.98	33.48	33.97	34.3	34.62	

Average = Sum(39)$_{1...12}$ /12= 34.09 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.92	0.92	0.9	0.89	0.87	0.87	0.87	0.88	0.89	0.9	0.91

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.36 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.38 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	73.02	70.36	67.71	65.05	62.4	59.74	59.74	62.4	65.05	67.71	70.36	73.02

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.58 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.29	94.71	97.73	85.2	81.75	70.55	65.37	75.02	75.91	88.47	96.57	104.87

Total = Sum(45)$_{1...12}$ = 1044.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.21	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.49	15.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59	

Output from water heater (annual)$_{1...12}$ 1276.58 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.78	45.74	48.27	43.59	42.96	38.72	37.51	40.72	40.5	45.19	47.37	50.64	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.99	23.08	18.77	14.21	10.62	8.97	9.69	12.6	16.91	21.47	25.06	26.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	174.05	175.85	171.3	161.61	149.38	137.89	130.21	128.4	132.95	142.64	154.87	166.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	(71)

Water heating gains (Table 5)

(72)m=	69.59	68.06	64.88	60.55	57.74	53.78	50.42	54.73	56.26	60.74	65.8	68.07	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	341.22	338.59	326.54	307.96	289.33	272.22	261.9	267.31	277.71	296.44	317.31	332.73	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.81	x	36.79	x	0.4	x	0.8	=	137.16	(77)
Southeast 0.9x	0.77	x	16.81	x	62.67	x	0.4	x	0.8	=	233.63	(77)
Southeast 0.9x	0.77	x	16.81	x	85.75	x	0.4	x	0.8	=	319.67	(77)
Southeast 0.9x	0.77	x	16.81	x	106.25	x	0.4	x	0.8	=	396.08	(77)
Southeast 0.9x	0.77	x	16.81	x	119.01	x	0.4	x	0.8	=	443.65	(77)

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Southeast	0.9x	0.77	x	16.81	x	118.15	x	0.4	x	0.8	=	440.44	(77)
Southeast	0.9x	0.77	x	16.81	x	113.91	x	0.4	x	0.8	=	424.63	(77)
Southeast	0.9x	0.77	x	16.81	x	104.39	x	0.4	x	0.8	=	389.15	(77)
Southeast	0.9x	0.77	x	16.81	x	92.85	x	0.4	x	0.8	=	346.13	(77)
Southeast	0.9x	0.77	x	16.81	x	69.27	x	0.4	x	0.8	=	258.21	(77)
Southeast	0.9x	0.77	x	16.81	x	44.07	x	0.4	x	0.8	=	164.29	(77)
Southeast	0.9x	0.77	x	16.81	x	31.49	x	0.4	x	0.8	=	117.38	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	137.16	233.63	319.67	396.08	443.65	440.44	424.63	389.15	346.13	258.21	164.29	117.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	478.38	572.22	646.21	704.04	732.98	712.66	686.53	656.46	623.84	554.65	481.6	450.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.82	0.75	0.65	0.53	0.41	0.29	0.21	0.23	0.36	0.57	0.75	0.84	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.29	20.57	20.81	20.93	20.98	21	20.99	20.96	20.8	20.4	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.15	20.15	20.17	20.17	20.19	20.19	20.2	20.18	20.17	20.17	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.8	0.72	0.63	0.5	0.38	0.26	0.17	0.19	0.32	0.53	0.73	0.82	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.85	19.25	19.62	19.94	20.1	20.18	20.19	20.19	20.15	19.95	19.42	18.79	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.77	20.09	20.37	20.51	20.58	20.59	20.59	20.56	20.38	19.91	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.77	20.09	20.37	20.51	20.58	20.59	20.59	20.56	20.38	19.91	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.79	0.72	0.63	0.51	0.39	0.27	0.19	0.21	0.34	0.54	0.72	0.81	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	377.48	409.14	404.94	359.88	287.71	195.53	131.67	137.42	210.83	300.65	345.68	363.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	533.56	522.15	475.13	391.63	299.31	198.16	132.29	138.25	216.16	332.08	439.43	525.33	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	116.12	75.94	52.22	22.86	8.63	0	0	0	0	23.39	67.5	120.64	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	487.3	(98)
Space heating requirement in kWh/m²/year	12.81	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	311.59	245.29	250.67	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	300.95	240.36	244.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	787.02	758.22	722.16	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	349.97	385.29	355.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1090.51	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	75.25	82.85	76.39	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	234.49	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.17	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	116.12	75.94	52.22	22.86	8.63	0	0	0	0	23.39	67.5	120.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	68.31	44.67	30.72	13.45	5.07	0	0	0	0	13.76	39.71	70.97	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	286.65	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59

Total = Sum(219a)$_{1...12}$ = 1276.58 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.01	15.42	14.22	0	0	0	0

Total = Sum(221)$_{6...8}$ = 43.64 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		286.65	
Water heating fuel used		1276.58	
Space cooling fuel used		43.64	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.74		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.74	(231)
Electricity for lighting		183.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.2	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	37.81	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.38	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	5.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.34	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.22	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.51	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.32	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	148.77	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				811.32	(265)
Space cooling	(221)	x	0.519	=	22.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.43	(267)
Electricity for lighting	(232)	x	0.519	=	95.29	(268)
Total CO2, kg/year		sum of (265)…(271) =			985.69	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.92	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	880	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3919.11	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4799.11	(265)
Space cooling	(221)	x	3.07	=	133.98	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.82	(267)
Electricity for lighting	(232)	x	0	=	563.65	(268)
'Total Primary Energy		sum of (265)…(271) =			5830.56	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.31	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.03	(1a) x	2.7	(2a) =	102.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.03	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.19 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.44 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.51	x 1/[1/(1.5)+ 0.04] =	13.46			(27)
Floor			38.03	x 0.13 =	4.9439			(28)
Walls	21.12	9.51	11.61	x 0.18 =	2.09			(29)
Total area of elements, m²			59.15					(31)
Party wall			36.52	x 0 =	0			(32)
Party wall			15.84	x 0 =	0			(32)
Party ceiling			38.03					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7082.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.21	20.09	19.96	19.38	19.27	18.76	18.76	18.66	18.96	19.27	19.49	19.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	43.01	42.89	42.76	42.18	42.07	41.56	41.56	41.46	41.76	42.07	42.29	42.52	

Average = Sum(39)$_{1...12}$ /12= 42.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.09	1.09	1.09	1.1	1.11	1.11	1.12

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.36 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.38 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.02	70.36	67.71	65.05	62.4	59.74	59.74	62.4	65.05	67.71	70.36	73.02

Total = Sum(44)$_{1...12}$ = 796.58 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.29	94.71	97.73	85.2	81.75	70.55	65.37	75.02	75.91	88.47	96.57	104.87

Total = Sum(45)$_{1...12}$ = 1044.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.21	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.49	15.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.24	136.21	143.68	129.67	127.71	115.02	111.33	120.97	120.38	134.42	141.04	150.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.24	136.21	143.68	129.67	127.71	115.02	111.33	120.97	120.38	134.42	141.04	150.82	

Output from water heater (annual)$_{1...12}$ 1585.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.77	64.69	69.26	63.91	63.95	59.03	58.5	61.71	60.82	66.18	67.69	71.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.4	9.23	7.51	5.69	4.25	3.59	3.88	5.04	6.76	8.59	10.02	10.69	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.61	117.82	114.77	108.28	100.09	92.39	87.24	86.03	89.08	95.57	103.77	111.47	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	(71)

Water heating gains (Table 5)

(72)m=	97.81	96.27	93.09	88.76	85.95	81.99	78.63	82.94	84.47	88.95	94.01	96.28	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	271.14	269.65	261.7	249.05	236.61	224.29	216.07	220.33	226.64	239.43	254.12	264.76	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.51	x	36.79	x	0.63	x	0.7	=	106.94	(77)
Southeast 0.9x	0.77	x	9.51	x	62.67	x	0.63	x	0.7	=	182.15	(77)
Southeast 0.9x	0.77	x	9.51	x	85.75	x	0.63	x	0.7	=	249.23	(77)
Southeast 0.9x	0.77	x	9.51	x	106.25	x	0.63	x	0.7	=	308.81	(77)
Southeast 0.9x	0.77	x	9.51	x	119.01	x	0.63	x	0.7	=	345.89	(77)

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Southeast 0.9x	0.77	x	9.51	x	118.15	x	0.63	x	0.7	=	343.39	(77)
Southeast 0.9x	0.77	x	9.51	x	113.91	x	0.63	x	0.7	=	331.06	(77)
Southeast 0.9x	0.77	x	9.51	x	104.39	x	0.63	x	0.7	=	303.4	(77)
Southeast 0.9x	0.77	x	9.51	x	92.85	x	0.63	x	0.7	=	269.86	(77)
Southeast 0.9x	0.77	x	9.51	x	69.27	x	0.63	x	0.7	=	201.32	(77)
Southeast 0.9x	0.77	x	9.51	x	44.07	x	0.63	x	0.7	=	128.09	(77)
Southeast 0.9x	0.77	x	9.51	x	31.49	x	0.63	x	0.7	=	91.52	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.94	182.15	249.23	308.81	345.89	343.39	331.06	303.4	269.86	201.32	128.09	91.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	378.08	451.81	510.93	557.86	582.5	567.68	547.13	523.73	496.5	440.75	382.21	356.27	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.91	0.8	0.64	0.46	0.33	0.36	0.57	0.84	0.96	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.14	20.36	20.61	20.84	20.96	20.99	21	21	20.98	20.83	20.45	20.1	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.95	0.88	0.76	0.58	0.39	0.26	0.29	0.49	0.79	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.18	19.52	19.83	19.96	20	20.01	20.01	19.99	19.82	19.32	18.82	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.77	20.07	20.33	20.46	20.5	20.5	20.5	20.49	20.32	19.88	19.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.77	20.07	20.33	20.46	20.5	20.5	20.5	20.49	20.32	19.88	19.46	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.94	0.88	0.77	0.61	0.43	0.3	0.32	0.53	0.81	0.94	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.92	425.98	452.03	430.33	354.98	243.35	161.95	169.78	261.69	355.03	361.02	348.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	653.92	637.71	580.12	482.15	368.35	245.07	162.14	170.1	266.61	409.08	540.68	648.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	212.78	142.28	95.3	37.31	9.94	0	0	0	0	40.21	129.35	223.19	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	890.36	(98)
Space heating requirement in kWh/m²/year	23.41	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
212.78	142.28	95.3	37.31	9.94	0	0	0	0	40.21	129.35	223.19	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
227.57	152.17	101.93	39.91	10.63	0	0	0	0	43	138.34	238.71	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 952.26 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.24	136.21	143.68	129.67	127.71	115.02	111.33	120.97	120.38	134.42	141.04	150.82

Efficiency of water heater 79.8 (216)

(217)m=	85.67	84.93	83.75	81.97	80.49	79.8	79.8	79.8	79.8	82.03	84.58	85.86	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.03	160.38	171.56	158.21	158.67	144.13	139.51	151.59	150.86	163.86	166.75	175.67

Total = Sum(219a)$_{1...12}$ = 1921.21 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		952.26
Water heating fuel used		1921.21
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.6 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.07 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	205.69	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =			620.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.29	(268)
Total CO2, kg/year	sum of (265)…(271) =			754.88	(272)

TER = 28.83 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.54	**(P1)**
Transmission heat loss coefficient:	22.9	
Summer heat loss coefficient:	158.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.81	112.1	0.4	0.8	0.9	488.44	
						Total	488.44	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.22	261.9	267.31	
Total summer gains	794.74	750.34	707.67	**(P5)**
Summer gain/loss ratio	5.02	4.73	4.47	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.02	22.43	22.07	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:36:16

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.55m²
Site Reference : P1785 St Michaels
Plot Reference: Level 17 Flat 17 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.33 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.95 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	35.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.027 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	86.55 m²	2.7 m
Living area:	42.39 m² (fraction 0.49)	
Front of dwelling faces:	North	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
e	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
e	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
e		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.84	7.59	0.24	0	True	N/A
Floor to heated non-dom	86.55			0.09			N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.7						N/A

SAP Input

PARTY CEILING	86.55	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0274

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.86	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 74.19 (fraction 0.857)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.55	(1a) x	2.7	(2a) =	233.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.55	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Floor			86.55	x	0.09	=	7.789501			(28)
Walls	47.43	39.84	7.59	x	0.24	=	1.82			(29)
Total area of elements, m²			133.98							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.7	x	0	=	0			(32)
Party ceiling			86.55							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16254.33 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.59 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.95	29.55	29.14	27.09	26.68	24.63	24.63	24.22	25.45	26.68	27.5	28.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.55	81.14	80.73	78.68	78.27	76.22	76.22	75.81	77.04	78.27	79.09	79.91	

Average = Sum(39)$_{1...12}$ /12= 78.58 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.93	0.91	0.9	0.88	0.88	0.88	0.89	0.9	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.9	101.09	97.28	93.46	89.65	85.83	85.83	89.65	93.46	97.28	101.09	104.9	

Total = Sum(44)$_{1...12}$ = 1144.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.57	136.06	140.4	122.41	117.45	101.35	93.92	107.77	109.06	127.1	138.74	150.66	

Total = Sum(45)$_{1...12}$ = 1500.51 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.34	20.41	21.06	18.36	17.62	15.2	14.09	16.17	16.36	19.06	20.81	22.6	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.52	163.11	170.35	151.39	147.4	130.33	123.87	137.72	138.04	157.05	167.72	180.61	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.52	163.11	170.35	151.39	147.4	130.33	123.87	137.72	138.04	157.05	167.72	180.61	

Output from water heater (annual)$_{1...12}$ — 1853.1 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.68	66.88	70.64	63.88	63.01	56.88	55.18	59.79	59.45	66.22	69.31	74.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.53	154.53	154.53	154.53	154.53	154.53	154.53	154.53	154.53	154.53	154.53	154.53	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.84	46.04	37.44	28.35	21.19	17.89	19.33	25.13	33.72	42.82	49.98	53.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	347.14	350.74	341.67	322.34	297.95	275.02	259.7	256.1	265.18	284.5	308.9	331.83	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.03	53.03	53.03	53.03	53.03	53.03	53.03	53.03	53.03	53.03	53.03	53.03	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	(71)

Water heating gains (Table 5)

(72)m=	101.73	99.52	94.95	88.73	84.69	79.01	74.17	80.36	82.56	89	96.27	99.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	605.24	600.85	578.6	543.96	508.37	476.45	457.75	466.13	486.01	520.87	559.69	589.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast	0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast	0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast	0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast	0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast	0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast	0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast	0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.67	1213.08	1416.27	1581.88	1670.93	1630.61	1570.47	1485.87	1393.03	1197.51	990.19	896.76	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.78	0.67	0.54	0.42	0.29	0.21	0.23	0.37	0.59	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	20.19	20.52	20.79	20.92	20.98	21	20.99	20.96	20.77	20.29	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.14	20.14	20.16	20.16	20.18	20.18	20.19	20.18	20.16	20.16	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.76	0.65	0.51	0.38	0.26	0.17	0.19	0.33	0.56	0.77	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	19.09	19.54	19.92	20.08	20.17	20.18	20.18	20.14	19.9	19.26	18.51	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.18	19.63	20.02	20.34	20.49	20.57	20.58	20.58	20.54	20.33	19.76	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.18	19.63	20.02	20.34	20.49	20.57	20.58	20.58	20.54	20.33	19.76	19.12	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.52	0.4	0.28	0.19	0.21	0.35	0.57	0.76	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	797.1	901.06	913.41	822.32	660.47	448.48	301.83	314.86	482.79	678.38	748.43	757.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1213.79	1194.95	1091.47	900.39	688.36	454.75	303.32	316.9	496.28	761.41	1001.34	1192.07	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	310.02	197.49	132.47	56.21	20.76	0	0	0	0	61.78	182.1	322.97	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1283.8	(98)
Space heating requirement in kWh/m²/year	14.83	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	716.48	564.03	576.16	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	692.04	552.68	562	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.46	1758.33	1658.04	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	816.06	897.01	815.45	0	0	0	0	
Total = Sum(104)$_{5...8}$ =													2528.52 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.86 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	174.88	192.23	174.75	0	0	0	0	
Total = Sum(107)$_{5...8}$ =													541.86 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.26 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	310.02	197.49	132.47	56.21	20.76	0	0	0	0	61.78	182.1	322.97	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	182.36	116.17	77.92	33.07	12.21	0	0	0	0	36.34	107.12	189.98	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													755.17 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	185.52	163.11	170.35	151.39	147.4	130.33	123.87	137.72	138.04	157.05	167.72	180.61

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.52	163.11	170.35	151.39	147.4	130.33	123.87	137.72	138.04	157.05	167.72	180.61

Total = Sum(219a)$_{1...12}$ = 1853.1 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.55	35.78	32.52	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.85 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		755.17	
Water heating fuel used		1853.1	
Space cooling fuel used		100.85	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.46		(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		247.46	(231)
Electricity for lighting		366.19	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3322.77	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	99.61	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.42	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.3	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.64	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.3	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		438.27	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.4	(257)
SAP rating (Section 12)		80.48	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	391.94	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1353.69	(265)
Space cooling	(221) x		0.519	=	52.34	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.43	(267)
Electricity for lighting	(232) x		0.519	=	190.05	(268)
Total CO2, kg/year		sum of (265)…(271) =			1724.52	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.93	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2318.39	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5689.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8007.4	(265)
Space cooling	(221) x		3.07	=	309.6	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.71	(267)
Electricity for lighting	(232) x		0	=	1124.2	(268)
'Total Primary Energy		sum of (265)…(271) =			10200.92	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.55	(1a) x	2.7	(2a) =	233.69	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.55	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.41	x1/[1/(1.5)+ 0.04]	=	14.73			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04]	=	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04]	=	1.97			(27)
Windows Type 4			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Floor			86.55	x 0.13	=	11.2515			(28)
Walls	47.43	21.64	25.79	x 0.18	=	4.64			(29)
Total area of elements, m²			133.98						(31)
Party wall			57.11	x 0	=	0			(32)
Party wall			23.7	x 0	=	0			(32)
Party ceiling			86.55						(32b)
Internal wall **			123.12						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16254.33 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.09 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.04	44.79	44.54	43.38	43.17	42.16	42.16	41.97	42.55	43.17	43.61	44.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	95.13	94.88	94.63	93.47	93.25	92.24	92.24	92.06	92.63	93.25	93.69	94.15	

Average = Sum(39)$_{1...12}$ /12= 93.47 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.1	1.1	1.09	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.58 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.37 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.9	101.09	97.28	93.46	89.65	85.83	85.83	89.65	93.46	97.28	101.09	104.9	

Total = Sum(44)$_{1...12}$ = 1144.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.57	136.06	140.4	122.41	117.45	101.35	93.92	107.77	109.06	127.1	138.74	150.66	

Total = Sum(45)$_{1...12}$ = 1500.51 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.34	20.41	21.06	18.36	17.62	15.2	14.09	16.17	16.36	19.06	20.81	22.6	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.66	181.31	190.5	170.88	167.55	149.83	144.01	157.87	157.54	177.19	187.22	200.75	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.66	181.31	190.5	170.88	167.55	149.83	144.01	157.87	157.54	177.19	187.22	200.75	

Output from water heater (annual)$_{1...12}$ — 2090.3 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.8	81.44	86.76	79.48	79.13	72.48	71.3	75.91	75.04	82.33	84.91	90.17	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.77	128.77	128.77	128.77	128.77	128.77	128.77	128.77	128.77	128.77	128.77	128.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.74	18.42	14.98	11.34	8.48	7.16	7.73	10.05	13.49	17.13	19.99	21.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.59	235	228.92	215.97	199.63	184.26	174	171.59	177.67	190.62	206.96	222.32	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.88	35.88	35.88	35.88	35.88	35.88	35.88	35.88	35.88	35.88	35.88	35.88	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	-103.02	(71)

Water heating gains (Table 5)

(72)m=	123.39	121.19	116.61	110.39	106.35	100.67	95.84	102.03	104.23	110.66	117.93	121.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.34	439.23	425.14	402.33	379.09	356.72	342.2	348.3	360.02	383.04	409.52	429.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.41	x	36.79	x	0.63	x	0.7	=	117.06	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.69	x	36.79	x	0.63	x	0.7	=	41.49	(77)
Southeast	0.9x	0.77	x	10.41	x	62.67	x	0.63	x	0.7	=	199.39	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.69	x	62.67	x	0.63	x	0.7	=	70.68	(77)
Southeast	0.9x	0.77	x	10.41	x	85.75	x	0.63	x	0.7	=	272.82	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.69	x	85.75	x	0.63	x	0.7	=	96.7	(77)
Southeast	0.9x	0.77	x	10.41	x	106.25	x	0.63	x	0.7	=	338.03	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.69	x	106.25	x	0.63	x	0.7	=	119.82	(77)
Southeast	0.9x	0.77	x	10.41	x	119.01	x	0.63	x	0.7	=	378.62	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.69	x	119.01	x	0.63	x	0.7	=	134.21	(77)
Southeast	0.9x	0.77	x	10.41	x	118.15	x	0.63	x	0.7	=	375.89	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.69	x	118.15	x	0.63	x	0.7	=	133.24	(77)
Southeast	0.9x	0.77	x	10.41	x	113.91	x	0.63	x	0.7	=	362.39	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.69	x	113.91	x	0.63	x	0.7	=	128.46	(77)
Southeast	0.9x	0.77	x	10.41	x	104.39	x	0.63	x	0.7	=	332.11	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.69	x	104.39	x	0.63	x	0.7	=	117.72	(77)
Southeast	0.9x	0.77	x	10.41	x	92.85	x	0.63	x	0.7	=	295.4	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.69	x	92.85	x	0.63	x	0.7	=	104.71	(77)
Southeast	0.9x	0.77	x	10.41	x	69.27	x	0.63	x	0.7	=	220.37	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.69	x	69.27	x	0.63	x	0.7	=	78.11	(77)
Southeast	0.9x	0.77	x	10.41	x	44.07	x	0.63	x	0.7	=	140.21	(77)

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Southeast 0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast 0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast 0.9x	0.77	x	3.69	x	44.07	x	0.63	x	0.7	=	49.7	(77)
Southeast 0.9x	0.77	x	10.41	x	31.49	x	0.63	x	0.7	=	100.18	(77)
Southeast 0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast 0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast 0.9x	0.77	x	3.69	x	31.49	x	0.63	x	0.7	=	35.51	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	243.33	414.49	567.12	702.69	787.07	781.38	753.33	690.38	614.07	458.1	291.46	208.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	684.68	853.72	992.26	1105.02	1166.16	1138.1	1095.54	1038.68	974.09	841.14	700.98	637.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.7	0.51	0.37	0.41	0.63	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	20	20.24	20.52	20.79	20.94	20.99	21	21	20.97	20.76	20.33	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.97	0.93	0.81	0.64	0.44	0.29	0.32	0.55	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.69	19.04	19.43	19.79	19.97	20.02	20.03	20.03	20.01	19.77	19.17	18.64	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.34	19.63	19.96	20.28	20.44	20.5	20.5	20.5	20.48	20.25	19.74	19.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.34	19.63	19.96	20.28	20.44	20.5	20.5	20.5	20.48	20.25	19.74	19.28	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.82	0.66	0.47	0.33	0.36	0.59	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	676.92	827.14	917.12	911.11	774.17	538.41	359.45	376.71	574	730.39	682.28	632.45	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1430.3	1397.15	1273.96	1063.78	815.35	543.95	360.08	377.79	590.95	900.3	1183.81	1420.23	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	560.52	383.05	265.49	109.92	30.64	0	0	0	0	126.41	361.1	586.11	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2423.23	(98)
Space heating requirement in kWh/m²/year	28	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
560.52	383.05	265.49	109.92	30.64	0	0	0	0	126.41	361.1	586.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
599.48	409.68	283.94	117.56	32.76	0	0	0	0	135.2	386.21	626.86	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2591.69 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

205.66	181.31	190.5	170.88	167.55	149.83	144.01	157.87	157.54	177.19	187.22	200.75	

Efficiency of water heater 79.8 (216)

(217)m=	87.36	86.76	85.7	83.67	81.29	79.8	79.8	79.8	79.8	83.93	86.54	87.51	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	235.43	208.97	222.28	204.23	206.12	187.76	180.46	197.83	197.41	211.11	216.34	229.42

Total = Sum(219a)$_{1...12}$ = 2497.36 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2591.69
Water heating fuel used		2497.36
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		366.19 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5530.24 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	559.8	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	539.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1099.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	190.05	(268)
Total CO2, kg/year	sum of (265)…(271) =			1328.21	(272)

TER = 22.33 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.46	**(P1)**
Transmission heat loss coefficient:	51.6	
Summer heat loss coefficient:	360.06	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (e)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (e)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (e)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.45	457.75	466.13	
Total summer gains	1845.7	1737.69	1620.08	**(P5)**
Summer gain/loss ratio	5.13	4.83	4.5	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.13	22.53	22.1	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:36:08

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 86.44m²

Site Reference : P1785 St Michaels

Plot Reference: Level 17 Flat 17 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.31 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.93 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.8 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.027 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.44 m²	2.7 m

Living area:	42.36 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.46	39.87	7.59	0.24	0	True	N/A
Floor to heated non-dom	86.44			0.09			N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A

SAP Input

PARTY CEILING	86.44	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0274

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.7	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.73 (fraction 0.853)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.44	(1a) x	2.7	(2a) =	233.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Floor			86.44	x	0.09	=	7.779601			(28)
Walls	47.46	39.87	7.59	x	0.24	=	1.82			(29)
Total area of elements, m²			133.9							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party ceiling			86.44							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.94 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16235.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.61 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.92	29.51	29.1	27.05	26.64	24.6	24.6	24.19	25.42	26.64	27.46	28.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.53	81.12	80.71	78.66	78.25	76.21	76.21	75.8	77.03	78.25	79.07	79.89	

Average = Sum(39)$_{1...12}$ /12= 78.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.93	0.91	0.91	0.88	0.88	0.88	0.89	0.91	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.86	101.05	97.23	93.42	89.61	85.79	85.79	89.61	93.42	97.23	101.05	104.86	

Total = Sum(44)$_{1...12}$ = 1143.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.5	136.01	140.35	122.36	117.4	101.31	93.88	107.73	109.01	127.05	138.68	150.6	

Total = Sum(45)$_{1...12}$ = 1499.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.05	18.35	17.61	15.2	14.08	16.16	16.35	19.06	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.45	163.05	170.29	151.34	147.35	130.29	123.83	137.67	137.99	156.99	167.66	180.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.45	163.05	170.29	151.34	147.35	130.29	123.83	137.67	137.99	156.99	167.66	180.54	

Output from water heater (annual)$_{1...12}$ — 1852.46 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.66	66.86	70.62	63.87	62.99	56.87	55.17	59.78	59.43	66.2	69.3	74.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.43	154.43	154.43	154.43	154.43	154.43	154.43	154.43	154.43	154.43	154.43	154.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.79	46	37.41	28.32	21.17	17.87	19.31	25.1	33.69	42.78	49.93	53.23	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.83	350.43	341.36	322.05	297.68	274.77	259.47	255.87	264.94	284.24	308.62	331.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	(71)

Water heating gains (Table 5)

(72)m=	101.7	99.49	94.92	88.7	84.67	78.99	74.16	80.34	82.54	88.98	96.24	99.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.81	600.41	578.18	543.57	508.01	476.12	457.43	465.81	485.67	520.5	559.29	588.75	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.5	1218.09	1417.13	1570.53	1645.27	1599.02	1542.61	1469.91	1390.07	1201.63	994.61	900.18	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.67	0.55	0.42	0.3	0.22	0.24	0.37	0.59	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	20.19	20.52	20.79	20.92	20.98	20.99	20.99	20.96	20.77	20.29	19.76	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.13	20.14	20.16	20.16	20.18	20.18	20.19	20.18	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.65	0.52	0.39	0.26	0.18	0.19	0.33	0.56	0.77	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.59	19.1	19.54	19.91	20.08	20.17	20.18	20.18	20.14	19.9	19.26	18.51	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.19	19.63	20.02	20.34	20.49	20.57	20.58	20.58	20.54	20.33	19.77	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.19	19.63	20.02	20.34	20.49	20.57	20.58	20.58	20.54	20.33	19.77	19.12	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.74	0.64	0.52	0.4	0.28	0.2	0.21	0.35	0.56	0.75	0.84	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	798.99	902.77	913.32	820.62	658.99	447.96	301.67	314.72	482.57	678.84	750.03	759.77	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1213.92	1195.06	1091.21	899.89	687.97	454.59	303.24	316.82	496.16	761.36	1001.48	1192.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	308.71	196.42	132.35	57.08	21.56	0	0	0	0	61.4	181.04	321.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1280.28	(98)
Space heating requirement in kWh/m²/year	14.81	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	716.36	563.94	576.07	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.96	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	690.59	551.98	561.45	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.6	1725.82	1639.44	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	790.57	873.33	802.02	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2465.92	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	168.58	186.23	171.02	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	525.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	308.71	196.42	132.35	57.08	21.56	0	0	0	0	61.4	181.04	321.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	181.59	115.54	77.85	33.58	12.68	0	0	0	0	36.12	106.5	189.25	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	753.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.45	163.05	170.29	151.34	147.35	130.29	123.83	137.67	137.99	156.99	167.66	180.54

Efficiency of water heater: 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.45	163.05	170.29	151.34	147.35	130.29	123.83	137.67	137.99	156.99	167.66	180.54

Total = Sum(219a)$_{1...12}$ = 1852.46 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	31.38	34.66	31.83	0	0	0	0

Total = Sum(221)$_{6...8}$ = 97.87 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		753.11	
Water heating fuel used		1852.46	
Space cooling fuel used		97.87	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.15		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.15	(231)
Electricity for lighting		365.86	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3316.44	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	99.33		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	244.34		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	12.91		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.6		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.26		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				437.44		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.4	(257)
SAP rating (Section 12)		80.5	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	390.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1352.29	(265)
Space cooling	(221)	x	0.519	=	50.79	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.27	(267)
Electricity for lighting	(232)	x	0.519	=	189.88	(268)
Total CO2, kg/year		sum of (265)…(271) =			1721.23	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2312.03	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5687.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7999.1	(265)
Space cooling	(221)	x	3.07	=	300.45	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.75	(267)
Electricity for lighting	(232)	x	0	=	1123.18	(268)
'Total Primary Energy		sum of (265)…(271) =			10181.47	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.79	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.44	(1a) x	2.7	(2a) =	233.39	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.39	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Floor			86.44	x 0.13 =	11.2372			(28)
Walls	47.46	21.61	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			133.9					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party ceiling			86.44					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16235.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.04 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.99	44.74	44.49	43.33	43.12	42.11	42.11	41.92	42.5	43.12	43.55	44.01	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	95.03	94.78	94.53	93.37	93.16	92.15	92.15	91.96	92.54	93.16	93.59	94.05	

Average = Sum(39)$_{1...12}$ /12= 93.37 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.1	1.1	1.09	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.86	101.05	97.23	93.42	89.61	85.79	85.79	89.61	93.42	97.23	101.05	104.86	

Total = Sum(44)$_{1...12}$ = 1143.93 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.5	136.01	140.35	122.36	117.4	101.31	93.88	107.73	109.01	127.05	138.68	150.6	

Total = Sum(45)$_{1...12}$ = 1499.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.05	18.35	17.61	15.2	14.08	16.16	16.35	19.06	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.6	181.25	190.44	170.83	167.5	149.79	143.97	157.82	157.49	177.14	187.16	200.69	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.6	181.25	190.44	170.83	167.5	149.79	143.97	157.82	157.49	177.14	187.16	200.69	

Output from water heater (annual)$_{1...12}$ — 2089.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.78	81.42	86.74	79.46	79.11	72.47	71.29	75.89	75.03	82.32	84.89	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.69	128.69	128.69	128.69	128.69	128.69	128.69	128.69	128.69	128.69	128.69	128.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.4	14.96	11.33	8.47	7.15	7.73	10.04	13.48	17.11	19.97	21.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.37	234.79	228.71	215.77	199.44	184.1	173.84	171.43	177.51	190.44	206.77	222.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	-102.95	(71)

Water heating gains (Table 5)

(72)m=	123.36	121.16	116.58	110.37	106.33	100.65	95.82	102.01	104.21	110.64	117.91	121.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.06	438.95	424.86	402.08	378.85	356.5	341.99	348.09	359.8	382.8	409.26	429.19	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.71	857.6	993.06	1097.26	1148.64	1116.6	1076.54	1027.75	972.17	844.33	704.44	640.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.7	0.52	0.38	0.41	0.63	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.25	20.52	20.79	20.94	20.99	21	21	20.97	20.76	20.33	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.82	0.64	0.44	0.29	0.32	0.55	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.7	19.04	19.43	19.79	19.96	20.02	20.03	20.03	20.01	19.77	19.17	18.64	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.63	19.96	20.28	20.44	20.5	20.5	20.5	20.48	20.26	19.74	19.29	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.63	19.96	20.28	20.44	20.5	20.5	20.5	20.48	20.26	19.74	19.29	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.83	0.67	0.48	0.33	0.37	0.59	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	679.74	830.34	917.41	907.45	770.95	537.34	359.03	376.28	573.34	731.69	685.21	635.02	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1429.3	1396.25	1272.82	1062.35	814.24	543.34	359.71	377.4	590.34	899.63	1183.06	1419.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	557.67	380.3	264.43	111.53	32.2	0	0	0	0	124.95	358.46	583.42	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2412.96	(98)
Space heating requirement in kWh/m²/year	27.91	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
557.67	380.3	264.43	111.53	32.2	0	0	0	0	124.95	358.46	583.42	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
596.44	406.73	282.81	119.29	34.44	0	0	0	0	133.64	383.38	623.98	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2580.7	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)

205.6	181.25	190.44	170.83	167.5	149.79	143.97	157.82	157.49	177.14	187.16	200.69

Efficiency of water heater	79.8	(216)

(217)m=	87.35	86.75	85.69	83.71	81.35	79.8	79.8	79.8	79.8	83.9	86.52	87.5	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	235.38	208.94	222.24	204.08	205.89	187.7	180.41	197.77	197.36	211.12	216.31	229.37
Total = Sum(219a)$_{1...12}$ =												2496.58 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2580.7
Water heating fuel used		2496.58
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		365.86 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5518.14 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	557.43	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	539.26	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1096.69	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.88	(268)
Total CO2, kg/year	sum of (265)…(271) =			1325.5	(272)

TER = 22.31 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.07	**(P1)**
Transmission heat loss coefficient:	51.6	
Summer heat loss coefficient:	359.68	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.12	457.43	465.81	
Total summer gains	1808.28	1705.69	1602.06	**(P5)**
Summer gain/loss ratio	5.03	4.74	4.45	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.03	22.44	22.05	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:59

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 38.03m²
Site Reference : P1785 St Michaels
Plot Reference: Level 17 Flat 17 09
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	31.66 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	28.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	41.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Thermal bridging	0.039 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 17 Flat 17 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	38.03 m²	2.7 m
Living area:	18.83 m² (fraction 0.495)	
Front of dwelling faces:	East	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Floor to heated non-dom	38.03			0.09			N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.23						N/A
PARTY CEILING	38.03						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.039

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.59	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.74 (fraction 0.861)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.03	(1a) x	2.7	(2a) =	102.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.03	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x	1/[1/(1)+ 0.04]	=	15.89			(27)
Floor			38.03	x	0.09	=	3.4227			(28)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			59.15							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.23	x	0	=	0			(32)
Party ceiling			38.03							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3279.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.73 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.35	12.19	12.02	11.2	11.04	10.22	10.22	10.05	10.55	11.04	11.37	11.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	35.08	34.92	34.75	33.93	33.77	32.95	32.95	32.78	33.27	33.77	34.1	34.42	

Average = Sum(39)$_{1...12}$ /12= 33.89 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.91	0.89	0.89	0.87	0.87	0.86	0.87	0.89	0.9	0.91

Average = Sum(40)$_{1...12}$ /12= 0.89 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.36 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 66.38 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	73.02	70.36	67.71	65.05	62.4	59.74	59.74	62.4	65.05	67.71	70.36	73.02	

Total = Sum(44)$_{1...12}$ = 796.58 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.29	94.71	97.73	85.2	81.75	70.55	65.37	75.02	75.91	88.47	96.57	104.87	

Total = Sum(45)$_{1...12}$ = 1044.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.21	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.49	15.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

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SAP WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59	

Output from water heater (annual)$_{1...12}$ 1276.58 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.78	45.74	48.27	43.59	42.96	38.72	37.51	40.72	40.5	45.19	47.37	50.64	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.99	23.08	18.77	14.21	10.62	8.97	9.69	12.6	16.91	21.47	25.06	26.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	174.05	175.85	171.3	161.61	149.38	137.89	130.21	128.4	132.95	142.64	154.87	166.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	44.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	(71)

Water heating gains (Table 5)

(72)m=	69.59	68.06	64.88	60.55	57.74	53.78	50.42	54.73	56.26	60.74	65.8	68.07	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	341.22	338.59	326.54	307.96	289.33	272.22	261.9	267.31	277.71	296.44	317.31	332.73	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	382.58	422.77	478.22	557.07	624.18	629.2	595.85	533.54	462.53	399.32	369.36	366.51	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.88	0.85	0.77	0.63	0.47	0.33	0.24	0.28	0.47	0.7	0.84	0.89	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.73	19.96	20.31	20.69	20.9	20.98	20.99	20.99	20.93	20.64	20.15	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.16	20.17	20.18	20.2	20.2	20.2	20.19	20.18	20.17	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.87	0.83	0.75	0.6	0.44	0.29	0.2	0.23	0.42	0.67	0.82	0.88	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.48	18.79	19.28	19.81	20.07	20.17	20.19	20.19	20.12	19.76	19.09	18.46	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.1	19.37	19.79	20.25	20.48	20.57	20.59	20.59	20.52	20.19	19.62	19.08	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.1	19.37	19.79	20.25	20.48	20.57	20.59	20.59	20.52	20.19	19.62	19.08	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.85	0.81	0.74	0.6	0.45	0.31	0.22	0.25	0.44	0.67	0.81	0.86	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	325.65	343.91	353.13	335.97	279.99	193.19	130.51	135.83	202.83	268.15	297.54	315.78	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	519.22	505.19	461.87	385.04	296.41	196.74	131.41	137.26	213.64	323.97	426.82	512.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	144.01	108.38	80.9	35.34	12.22	0	0	0	0	41.53	93.08	146.05	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	661.5	(98)
Space heating requirement in kWh/m²/year	17.39	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	309.69	243.8	249.14	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.95	0.97	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	295.32	236.72	238.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	689.47	652.23	578.49	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	283.79	309.14	252.7	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	845.64	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	61.08	66.54	54.39	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	182	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.79	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	144.01	108.38	80.9	35.34	12.22	0	0	0	0	41.53	93.08	146.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	84.71	63.75	47.59	20.79	7.19	0	0	0	0	24.43	54.75	85.91	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	389.12	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	128	112.52	117.45	104.28	101.47	89.63	85.09	94.73	94.99	108.18	115.65	124.59

Total = Sum(219a)$_{1...12}$ = 1276.58 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.37	12.38	10.12	0	0	0	0

Total = Sum(221)$_{6...8}$ = 33.87 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		389.12	
Water heating fuel used		1276.58	
Space cooling fuel used		33.87	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.74		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.74	(231)
Electricity for lighting		183.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1991.91	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	51.32	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.38	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.47	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.34	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.22	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				262.73	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.46	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	201.95	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				864.5	(265)
Space cooling	(221) x		0.519	=	17.58	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.43	(267)
Electricity for lighting	(232) x		0.519	=	95.29	(268)
Total CO2, kg/year		sum of (265)…(271) =			1033.8	(272)
CO2 emissions per m²		(272) ÷ (4) =			27.18	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1194.59	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3919.11	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5113.7	(265)
Space cooling	(221) x		3.07	=	103.99	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.82	(267)
Electricity for lighting	(232) x		0	=	563.65	(268)
'Total Primary Energy		sum of (265)…(271) =			6115.16	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			160.8	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.03	(1a) x	2.7	(2a) =	102.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.03	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.19 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.44 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.51	x 1/[1/(1.5)+ 0.04] =	13.46			(27)
Floor			38.03	x 0.13 =	4.9439			(28)
Walls	21.12	9.51	11.61	x 0.18 =	2.09			(29)
Total area of elements, m²			59.15					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.23	x 0 =	0			(32)
Party ceiling			38.03					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3279.93 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.21	20.09	19.96	19.38	19.27	18.76	18.76	18.66	18.96	19.27	19.49	19.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	43.02	42.89	42.76	42.18	42.07	41.56	41.56	41.47	41.76	42.07	42.29	42.52	

Average = Sum(39)$_{1...12}$ /12= 42.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.09	1.09	1.09	1.1	1.11	1.11	1.12

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.36 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.38 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.02	70.36	67.71	65.05	62.4	59.74	59.74	62.4	65.05	67.71	70.36	73.02

Total = Sum(44)$_{1...12}$ = 796.58 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.29	94.71	97.73	85.2	81.75	70.55	65.37	75.02	75.91	88.47	96.57	104.87

Total = Sum(45)$_{1...12}$ = 1044.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.21	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.49	15.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.24	136.21	143.68	129.67	127.71	115.02	111.33	120.97	120.38	134.42	141.04	150.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.24	136.21	143.68	129.67	127.71	115.02	111.33	120.97	120.38	134.42	141.04	150.82	

Output from water heater (annual)$_{1...12}$ 1585.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.77	64.69	69.26	63.91	63.95	59.03	58.5	61.71	60.82	66.18	67.69	71.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.4	9.23	7.51	5.69	4.25	3.59	3.88	5.04	6.76	8.59	10.02	10.69	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.61	117.82	114.77	108.28	100.09	92.39	87.24	86.03	89.08	95.57	103.77	111.47	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	29.78	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	-54.2	(71)

Water heating gains (Table 5)

(72)m=	97.81	96.27	93.09	88.76	85.95	81.99	78.63	82.94	84.47	88.95	94.01	96.28	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	271.14	269.65	261.7	249.05	236.61	224.29	216.07	220.33	226.64	239.43	254.12	264.76	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.51	x	11.28	x	0.63	x	0.7	=	32.79	(81)
Northwest 0.9x	0.77	x	9.51	x	22.97	x	0.63	x	0.7	=	66.75	(81)
Northwest 0.9x	0.77	x	9.51	x	41.38	x	0.63	x	0.7	=	120.26	(81)
Northwest 0.9x	0.77	x	9.51	x	67.96	x	0.63	x	0.7	=	197.51	(81)
Northwest 0.9x	0.77	x	9.51	x	91.35	x	0.63	x	0.7	=	265.49	(81)

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Northwest	0.9x	0.77	x	9.51	x	97.38	x	0.63	x	0.7	=	283.04	(81)
Northwest	0.9x	0.77	x	9.51	x	91.1	x	0.63	x	0.7	=	264.77	(81)
Northwest	0.9x	0.77	x	9.51	x	72.63	x	0.63	x	0.7	=	211.08	(81)
Northwest	0.9x	0.77	x	9.51	x	50.42	x	0.63	x	0.7	=	146.54	(81)
Northwest	0.9x	0.77	x	9.51	x	28.07	x	0.63	x	0.7	=	81.57	(81)
Northwest	0.9x	0.77	x	9.51	x	14.2	x	0.63	x	0.7	=	41.26	(81)
Northwest	0.9x	0.77	x	9.51	x	9.21	x	0.63	x	0.7	=	26.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.79	66.75	120.26	197.51	265.49	283.04	264.77	211.08	146.54	81.57	41.26	26.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.93	336.4	381.96	446.56	502.1	507.33	480.84	431.41	373.18	321.01	295.38	291.54	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.89	0.72	0.52	0.38	0.44	0.71	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.11	20.38	20.72	20.92	20.99	21	21	20.95	20.66	20.26	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.86	0.66	0.44	0.29	0.35	0.63	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.62	18.83	19.21	19.68	19.93	20	20.01	20.01	19.96	19.62	19.06	18.6	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.29	19.46	19.79	20.2	20.42	20.49	20.5	20.5	20.45	20.14	19.66	19.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.29	19.46	19.79	20.2	20.42	20.49	20.5	20.5	20.45	20.14	19.66	19.26	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.34	0.39	0.67	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	300.41	329.66	363.98	385.77	344.26	241.96	161.61	169.11	250.52	294.02	288.86	288.74	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	644.7	624.64	568.28	476.41	366.96	244.78	161.97	169.88	265.19	401.16	530.97	640.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	256.15	198.23	152	65.26	16.89	0	0	0	0	79.72	174.32	261.76	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1204.32	(98)
Space heating requirement in kWh/m²/year	31.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
256.15	198.23	152	65.26	16.89	0	0	0	0	79.72	174.32	261.76	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
273.96	212.01	162.57	69.79	18.06	0	0	0	0	85.26	186.43	279.96	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1288.04	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	154.24	136.21	143.68	129.67	127.71	115.02	111.33	120.97	120.38	134.42	141.04	150.82	
Efficiency of water heater												79.8	(216)
(217)m=	86.16	85.81	84.96	83.09	80.92	79.8	79.8	79.8	79.8	83.47	85.38	86.27	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	179.02	158.73	169.11	156.07	157.82	144.13	139.51	151.59	150.86	161.03	165.19	174.82	
Total = Sum(219a)$_{1...12}$ =												1907.88	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1288.04	
Water heating fuel used		1907.88	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3454.53	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	278.22	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	412.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =			690.32	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.29	(268)
Total CO2, kg/year	sum of (265)…(271) =			824.53	(272)

TER = 31.66 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.54	**(P1)**
Transmission heat loss coefficient:	22.7	
Summer heat loss coefficient:	158.27	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.22	261.9	267.31	
Total summer gains	695.73	646.04	568.58	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.59	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.19	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:52

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.62m²
Site Reference : P1785 St Michaels
Plot Reference: Level 17 Flat 17 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	27.26 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.56 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	44.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

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Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	2.56m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.026 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.62 m²	2.7 m

Living area:	30.73 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	2.56	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Floor to heated non-dom	50.62			0.09			N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0258

	Length	Psi-value		
[Approved]	12.77	0.05	E4	Jamb
[Approved]	11.75	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.98	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.64 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Floor			50.62	x	0.09	=	4.5558			(28)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			73.01							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4253.34 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 25.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.44	16.22	16	14.91	14.69	13.6	13.6	13.38	14.04	14.69	15.13	15.57	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.16	41.94	41.72	40.63	40.41	39.32	39.32	39.1	39.76	40.41	40.85	41.28	

Average = Sum(39)$_{1...12}$ /12= 40.57 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.78	0.78	0.77	0.79	0.8	0.81	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Output from water heater (annual)$_{1...12}$ | 1408.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.33	49.72	52.38	47.18	46.39	41.69	40.26	43.87	43.7	48.91	51.43	55.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.17	29.46	23.96	18.14	13.56	11.45	12.37	16.08	21.58	27.4	31.98	34.1	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.16	224.46	218.65	206.28	190.67	176	166.2	163.89	169.7	182.07	197.68	212.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	75.71	73.98	70.4	65.52	62.36	57.9	54.11	58.96	60.69	65.74	71.43	73.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.17	409.04	394.14	371.07	347.72	326.47	313.8	320.06	333.1	356.33	382.23	401.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	1	=	7.55	(74)
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	0.7	=	3.24	(74)

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North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	1	=	14.42	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	1	=	24.5	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	0.7	=	10.52	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	1	=	39.36	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	0.7	=	16.9	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	1	=	53.02	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	0.7	=	22.76	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	1	=	56.76	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	0.7	=	24.37	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	1	=	52.99	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	0.7	=	22.75	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	1	=	42.04	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	0.7	=	18.05	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	1	=	29.46	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	0.7	=	12.65	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	1	=	17.17	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	0.7	=	7.37	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	1	=	9.31	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	0.7	=	4	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	1	=	6.29	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	0.7	=	2.7	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	76.73	149.61	247.46	366.08	455.48	469.82	445.79	377.96	289.18	177.6	95.53	63.22

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	488.89	558.64	641.6	737.15	803.2	796.29	759.6	698.02	622.28	533.93	477.75	464.79

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.88	0.83	0.74	0.6	0.45	0.31	0.23	0.26	0.42	0.67	0.83	0.89	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.16	20.49	20.79	20.93	20.99	21	20.99	20.96	20.75	20.31	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.23	20.23	20.25	20.25	20.27	20.27	20.28	20.27	20.25	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.87	0.81	0.72	0.57	0.42	0.28	0.19	0.22	0.38	0.64	0.81	0.88	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.79	19.14	19.58	20	20.18	20.26	20.27	20.27	20.23	19.96	19.37	18.76	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.47	19.76	20.13	20.48	20.64	20.7	20.71	20.71	20.67	20.44	19.94	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.47	19.76	20.13	20.48	20.64	20.7	20.71	20.71	20.67	20.44	19.94	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.85	0.8	0.72	0.58	0.43	0.3	0.21	0.24	0.41	0.65	0.8	0.87	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	417.5	449.03	459.75	425.47	346.73	236.97	160.98	167.54	252.84	344.62	382.97	402.65	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	639.64	623.15	568.74	470.56	361.19	239.88	161.65	168.57	261.25	397.59	524.49	629.28	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	165.27	117.01	81.09	32.46	10.76	0	0	0	0	39.41	101.9	168.62	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 716.51 (98)

Space heating requirement in kWh/m²/year 14.15 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	369.6	290.96	297.16	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	357.79	285.55	289.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	875.61	834.86	761.84	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	372.83	408.69	351.31	0	0	0	0	

Total = Sum(104) = 1132.83 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	80.36	88.08	75.72	0	0	0	0

Total = Sum(107) = 244.16 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.82 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	165.27	117.01	81.09	32.46	10.76	0	0	0	0	39.41	101.9	168.62	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	97.22	68.83	47.7	19.1	6.33	0	0	0	0	23.18	59.94	99.19	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 421.47 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Total = Sum(219a)$_{1...12}$ = 1408.62 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.96	16.39	14.09	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 45.44 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		421.47
Water heating fuel used		1408.62
Space cooling fuel used		45.44

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.73	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.73	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2254.61	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	55.59	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.8	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	5.99	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.09	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.91	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					297.38	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)	81.78	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	218.74	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.07	(264)
Space and water heating	(261) + (262) + (263) + (264) =					949.82	(265)
Space cooling	(221)	x		0.519	=	23.58	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.12	(267)

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Electricity for lighting	(232) x	0.519	=	121.62	(268)
Total CO2, kg/year	sum of (265)…(271) =			1170.14	(272)
CO2 emissions per m²	(272) ÷ (4) =			23.12	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1293.92	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4324.47	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5618.39	(265)
Space cooling	(221) x		3.07	=	139.5	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	444.33	(267)
Electricity for lighting	(232) x		0	=	719.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6921.66	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				136.74	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 3			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Floor			50.62	x 0.13 =	6.5806			(28)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			73.01					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4253.34 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 28.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.01	25.88	25.74	25.13	25.01	24.47	24.47	24.37	24.68	25.01	25.24	25.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.03	53.9	53.76	53.15	53.03	52.49	52.49	52.39	52.7	53.03	53.26	53.51	

Average = Sum(39)$_{1...12}$ /12= 53.14 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.03	1.04	1.05	1.05	1.06	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	

Output from water heater (annual)$_{1...12}$ | 1722.95 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.69	69.01	73.73	67.84	67.75	62.35	61.61	65.23	64.36	70.26	72.1	76.41	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.27	11.79	9.58	7.26	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.84	150.39	146.5	138.21	127.75	117.92	111.35	109.81	113.7	121.99	132.45	142.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	104.42	102.69	99.1	94.23	91.06	86.6	82.82	87.67	89.39	94.44	100.14	102.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.16	316.49	306.81	291.32	275.86	260.73	250.74	255.54	263.35	279.02	297.01	310.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)

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North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.47	133.54	220.81	326.26	405.43	417.93	396.67	336.67	257.93	158.52	85.26	56.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.63	450.03	527.62	617.58	681.3	678.66	647.41	592.21	521.29	437.54	382.26	366.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.99	0.96	0.86	0.68	0.49	0.36	0.41	0.66	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.2	20.48	20.79	20.95	20.99	21	21	20.97	20.72	20.31	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.83	0.63	0.42	0.28	0.32	0.59	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.74	19	19.4	19.81	20	20.05	20.05	20.05	20.03	19.74	19.17	18.7	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.52	19.73	20.06	20.41	20.58	20.62	20.63	20.63	20.6	20.34	19.86	19.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.52	19.73	20.06	20.41	20.58	20.62	20.63	20.63	20.6	20.34	19.86	19.48	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.84	0.66	0.46	0.33	0.37	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.95	440.67	498.03	518.63	449.06	313.48	211.07	220.82	329.67	395.95	374.6	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	822.33	799.15	728.8	611.5	470.69	316.1	211.38	221.45	342.43	516.32	679.89	817.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	326.9	240.9	171.69	66.86	16.09	0	0	0	0	89.56	219.8	337.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1469.53 (98)

Space heating requirement in kWh/m²/year 29.03 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	326.9	240.9	171.69	66.86	16.09	0	0	0	0	89.56	219.8	337.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	349.63	257.64	183.63	71.51	17.21	0	0	0	0	95.78	235.09	361.21	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1571.69 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54

Efficiency of water heater 79.8 (216)

(217)m=	86.55	86.1	85.06	82.96	80.79	79.8	79.8	79.8	79.8	83.55	85.77	86.69

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.55	172.6	183.98	169.84	171.43	155.87	150.44	164.05	163.44	174.81	179.2	189.8

Total = Sum(219a)$_{1...12}$ = 2070 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1571.69	
Water heating fuel used		2070	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3951.03	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	339.49	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	447.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				786.6	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.62	(268)
Total CO2, kg/year		sum of (265)…(271) =			947.15	(272)

TER = 27.26 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.41	**(P1)**
Transmission heat loss coefficient:	25.7	
Summer heat loss coefficient:	206.13	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	2.56	73.49	0.4	1	0.9	60.96	
North (N GLAZED DOOR)	0.9 x	1.57	73.49	0.4	0.7	0.9	26.17	
						Total	512.79	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.47	313.8	320.06	
Total summer gains	883.85	826.59	747.77	**(P5)**
Summer gain/loss ratio	4.29	4.01	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.29	21.71	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:42

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.62m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 17 Flat 17 11
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.28 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.01 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.87 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.59m²
Windows facing: South	2.54m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.024 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 17 Flat 17 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.62 m²	2.7 m

Living area:	30.73 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.59	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.54	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Floor to heated non-dom	50.62			0.09			N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0239

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.97	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43 (fraction 0.849)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.59	x 1/[1/(1)+ 0.04]		=	1.53			(27)
Windows Type 3			2.54	x 1/[1/(1)+ 0.04]		=	2.44			(27)
Floor			50.62	x	0.09	=	4.5558			(28)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			73.01							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8302.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 25.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	16.44	16.22	16	14.91	14.69	13.6	13.6	13.38	14.04	14.69	15.13	15.57	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	42.02	41.8	41.59	40.49	40.28	39.18	39.18	38.96	39.62	40.28	40.71	41.15	

Average = Sum(39)$_{1...12}$ /12= 40.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Output from water heater (annual)$_{1...12}$ — 1408.62 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.33	49.72	52.38	47.18	46.39	41.69	40.26	43.87	43.7	48.91	51.43	55.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.17	29.46	23.96	18.14	13.56	11.45	12.37	16.08	21.58	27.4	31.98	34.1	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.16	224.46	218.65	206.28	190.67	176	166.2	163.89	169.7	182.07	197.68	212.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	46.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	75.71	73.98	70.4	65.52	62.36	57.9	54.11	58.96	60.69	65.74	71.43	73.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.17	409.04	394.14	371.07	347.72	326.47	313.8	320.06	333.1	356.33	382.23	401.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.54	x	46.75	x	0.4	x	0.7	=	23.04	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.54	x	76.57	x	0.4	x	0.7	=	37.74	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.54	x	97.53	x	0.4	x	0.7	=	48.07	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.54	x	110.23	x	0.4	x	0.7	=	54.33	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.54	x	114.87	x	0.4	x	0.7	=	56.62	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.54	x	110.55	x	0.4	x	0.7	=	54.48	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.54	x	108.01	x	0.4	x	0.7	=	53.23	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.54	x	104.89	x	0.4	x	0.7	=	51.7	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.54	x	101.89	x	0.4	x	0.7	=	50.22	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.54	x	82.59	x	0.4	x	0.7	=	40.7	(78)
South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.54	x	55.42	x	0.4	x	0.7	=	27.31	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.54	x	40.4	x	0.4	x	0.7	=	19.91	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	109.59	200.48	303.49	412.74	486.95	491.9	470.89	415.8	342.19	230.17	133.96	91.94	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	521.76	609.52	697.63	783.81	834.66	818.37	784.7	735.86	675.29	586.5	516.18	493.51	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.8	0.71	0.57	0.43	0.3	0.22	0.24	0.39	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.26	20.56	20.82	20.94	20.99	21	21	20.97	20.8	20.39	19.96	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.78	0.68	0.54	0.4	0.27	0.18	0.2	0.35	0.59	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.28	19.68	20.04	20.19	20.26	20.27	20.28	20.24	20.02	19.47	18.87	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.57	19.88	20.22	20.51	20.65	20.7	20.71	20.71	20.68	20.49	20.03	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.57	19.88	20.22	20.51	20.65	20.7	20.71	20.71	20.68	20.49	20.03	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.77	0.68	0.55	0.42	0.29	0.2	0.23	0.38	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	436.09	472.03	476.53	431.43	347.48	236.52	160.55	167.2	254.13	354.93	400.07	419.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	641.77	626.1	570.43	470.32	360.33	239.14	161.15	168.05	260.74	398.35	526.41	631.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	153.02	103.53	69.87	28	9.56	0	0	0	0	32.3	90.97	157.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 644.52 (98)

Space heating requirement in kWh/m²/year 12.73 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	368.32	289.95	296.13	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	357.65	285.17	289.87	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.42	864.2	806.06	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	391.52	430.8	384.05	0	0	0	0	

Total = Sum(104) = 1206.36 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	83.15	91.49	81.56	0	0	0	0

Total = Sum(107) = 256.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.06 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	153.02	103.53	69.87	28	9.56	0	0	0	0	32.3	90.97	157.26	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	90.01	60.9	41.1	16.47	5.62	0	0	0	0	19	53.51	92.51	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 379.13 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.69	124.49	129.8	115.05	111.81	98.55	93.35	104.22	104.59	119.37	127.86	137.84	

Total = Sum(219a)$_{1...12}$ = 1408.62 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.47	17.03	15.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.68 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		379.13
Water heating fuel used		1408.62
Space cooling fuel used		47.68

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.73	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.73	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2214.51	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	50.01	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.8	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.29	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.09	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.91	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					292.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.28	(257)
SAP rating (Section 12)	82.1	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	196.77	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.07	(264)
Space and water heating	(261) + (262) + (263) + (264) =					927.84	(265)
Space cooling	(221)	x		0.519	=	24.75	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.12	(267)

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Electricity for lighting	(232) x	0.519	=	121.62	(268)
Total CO2, kg/year	sum of (265)…(271) =			1149.33	(272)
CO2 emissions per m²	(272) ÷ (4) =			22.71	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1163.92	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4324.47	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5488.39	(265)
Space cooling	(221) x		3.07	=	146.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	444.33	(267)
Electricity for lighting	(232) x		0	=	719.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6798.54	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				134.31	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.62	(1a) x	2.7	(2a) =	136.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.67	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.04	x1/[1/(1.5)+ 0.04] =	1.47			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Floor			50.62	x 0.13 =	6.5806			(28)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			73.01					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8302.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 27.88 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.01	25.88	25.74	25.13	25.01	24.47	24.47	24.37	24.68	25.01	25.24	25.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	53.89	53.76	53.63	53.01	52.89	52.36	52.36	52.26	52.56	52.89	53.13	53.37	

Average = Sum(39)$_{1...12}$ /12= 53.01 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.25	79.26	76.27	73.28	70.29	67.3	67.3	70.29	73.28	76.27	79.26	82.25	

Total = Sum(44)$_{1...12}$ = 897.28 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.98	106.68	110.09	95.97	92.09	79.47	73.64	84.5	85.51	99.65	108.78	118.13	

Total = Sum(45)$_{1...12}$ = 1176.48 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.3	16	16.51	14.4	13.81	11.92	11.05	12.68	12.83	14.95	16.32	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54	

Output from water heater (annual)$_{1...12}$ — 1722.95 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.69	69.01	73.73	67.84	67.75	62.35	61.61	65.23	64.36	70.26	72.1	76.41	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	85.42	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.27	11.79	9.58	7.26	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.84	150.39	146.5	138.21	127.75	117.92	111.35	109.81	113.7	121.99	132.45	142.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	-68.33	(71)

Water heating gains (Table 5)

(72)m=	104.42	102.69	99.1	94.23	91.06	86.6	82.82	87.67	89.39	94.44	100.14	102.7	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.16	316.49	306.81	291.32	275.86	260.73	250.74	255.54	263.35	279.02	297.01	310.24	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.04	x	46.75	x	0.63	x	0.7	=	14.86	(78)
South	0.9x	0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)
South	0.9x	0.77	x	1.04	x	76.57	x	0.63	x	0.7	=	24.34	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.04	x	97.53	x	0.63	x	0.7	=	31	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.04	x	110.23	x	0.63	x	0.7	=	35.04	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.04	x	114.87	x	0.63	x	0.7	=	36.51	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.04	x	110.55	x	0.63	x	0.7	=	35.14	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.04	x	108.01	x	0.63	x	0.7	=	34.33	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.04	x	104.89	x	0.63	x	0.7	=	33.34	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.04	x	101.89	x	0.63	x	0.7	=	32.38	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.04	x	82.59	x	0.63	x	0.7	=	26.25	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.04	x	55.42	x	0.63	x	0.7	=	17.61	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.04	x	40.4	x	0.63	x	0.7	=	12.84	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	416.54	496.62	579.8	662.95	714.55	703.97	675.02	630.02	571.29	485.9	417.3	392.76	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.83	0.66	0.47	0.34	0.38	0.61	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.08	20.28	20.56	20.83	20.96	20.99	21	21	20.98	20.78	20.38	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.04	20.05	20.05	20.05	20.06	20.05	20.05	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.6	0.4	0.27	0.3	0.54	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.12	19.5	19.86	20.01	20.05	20.05	20.06	20.04	19.81	19.26	18.78	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.59	19.83	20.14	20.45	20.59	20.62	20.63	20.63	20.61	20.4	19.94	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.59	19.83	20.14	20.45	20.59	20.62	20.63	20.63	20.61	20.4	19.94	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.81	0.63	0.44	0.31	0.35	0.58	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	411.11	481.43	535.16	536.16	452.26	313.22	210.64	220.49	333.41	422.95	405.44	388.84	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	823.96	802.37	731.72	612.16	469.99	315.38	210.89	220.95	342.08	518.36	682.11	819.06	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	307.16	215.67	146.24	54.72	13.19	0	0	0	0	70.98	199.2	320.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1327.25 (98)

Space heating requirement in kWh/m²/year 26.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	307.16	215.67	146.24	54.72	13.19	0	0	0	0	70.98	199.2	320.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	328.52	230.66	156.4	58.53	14.11	0	0	0	0	75.92	213.05	342.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1419.52 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.39	148.6	156.5	140.89	138.5	124.38	120.05	130.91	130.42	146.07	153.69	164.54

Efficiency of water heater 79.8 (216)

(217)m=	86.4	85.81	84.63	82.53	80.63	79.8	79.8	79.8	79.8	83.01	85.51	86.56

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.9	173.18	184.91	170.71	171.78	155.87	150.44	164.05	163.44	175.96	179.75	190.09

Total = Sum(219a)$_{1...12}$ = 2075.08 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1419.52	
Water heating fuel used		2075.08	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3803.94	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	306.62	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	448.22	(264)
Space and water heating	(261) + (262) + (263) + (264) =				754.83	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.62	(268)
Total CO2, kg/year		sum of (265)…(271) =			915.38	(272)

TER = 26.28 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.41	**(P1)**
Transmission heat loss coefficient:	25.6	
Summer heat loss coefficient:	205.99	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
South (S GLAZED DOOR)	0.9 x	2.54	106.3	0.4	0.7	0.9	61.23	
						Total	541.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.47	313.8	320.06	
Total summer gains	910.05	855.46	790.58	**(P5)**
Summer gain/loss ratio	4.42	4.15	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.42	21.85	21.44	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:35

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 38.02m²
Site Reference : P1785 St Michaels
Plot Reference: Level 17 Flat 17 12
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	31.66 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	28.65 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.09 (max. 0.25)	0.09 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.83 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Thermal bridging	0.039 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.09 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 17 Flat 17 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	38.02 m²	2.7 m
Living area:	18.71 m² (fraction 0.492)	
Front of dwelling faces:	East	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Floor to heated non-dom	38.02			0.09			N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.23						N/A
PARTY CEILING	38.02						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0391

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.76	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.02	(1a) x	2.7	(2a) =	102.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.02	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x	1/[1/(1)+ 0.04]	=	15.22			(27)
Floor			38.02	x	0.09	=	3.4218			(28)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			59.14							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.23	x	0	=	0			(32)
Party ceiling			38.02							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3279.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.35	12.18	12.02	11.2	11.04	10.22	10.22	10.05	10.54	11.04	11.36	11.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	34.57	34.41	34.25	33.43	33.26	32.44	32.44	32.28	32.77	33.26	33.59	33.92	

Average = Sum(39)$_{1...12}$ /12= 33.38 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.9	0.88	0.87	0.85	0.85	0.85	0.86	0.87	0.88	0.89

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.38 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	73.01	70.36	67.7	65.05	62.39	59.74	59.74	62.39	65.05	67.7	70.36	73.01

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.51 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.28	94.7	97.72	85.2	81.75	70.54	65.37	75.01	75.91	88.46	96.56	104.86

Total = Sum(45)$_{1...12}$ = 1044.35 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.48	15.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.99	112.51	117.44	104.28	101.46	89.62	85.08	94.73	94.99	108.18	115.64	124.58	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.99	112.51	117.44	104.28	101.46	89.62	85.08	94.73	94.99	108.18	115.64	124.58	

Output from water heater (annual)$_{1...12}$ 1276.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.77	45.73	48.27	43.59	42.95	38.72	37.51	40.71	40.5	45.19	47.37	50.64	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	81.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.98	23.08	18.77	14.21	10.62	8.97	9.69	12.59	16.9	21.46	25.05	26.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	174.01	175.82	171.27	161.58	149.35	137.86	130.18	128.38	132.93	142.61	154.84	166.33	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	(71)

Water heating gains (Table 5)

(72)m=	69.59	68.06	64.87	60.54	57.73	53.78	50.41	54.72	56.25	60.73	65.79	68.06	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	341.16	338.53	326.49	307.91	289.29	272.18	261.86	267.27	277.66	296.39	317.27	332.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.77	419.16	471.75	546.47	609.95	614.05	581.67	522.23	454.66	394.92	367.1	365.03	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.88	0.85	0.77	0.63	0.48	0.33	0.24	0.28	0.47	0.7	0.84	0.89	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.76	19.98	20.32	20.7	20.9	20.98	20.99	20.99	20.93	20.65	20.18	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.21	20.2	20.19	20.18	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.87	0.83	0.75	0.6	0.44	0.29	0.2	0.23	0.42	0.67	0.82	0.88	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.53	18.83	19.31	19.83	20.08	20.19	20.2	20.2	20.13	19.78	19.13	18.5	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.13	19.39	19.81	20.26	20.48	20.58	20.59	20.59	20.53	20.21	19.64	19.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.13	19.39	19.81	20.26	20.48	20.58	20.59	20.59	20.53	20.21	19.64	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.85	0.81	0.74	0.61	0.45	0.31	0.22	0.26	0.44	0.67	0.81	0.86	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	324.01	341.18	349.21	331.41	276	190.39	128.64	133.89	200.12	265.37	295.6	314.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	512.88	498.76	455.68	379.56	292.12	193.85	129.5	135.26	210.56	319.55	421.36	505.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	140.52	105.89	79.22	34.67	11.99	0	0	0	0	40.31	90.55	142.4	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	645.54	(98)
Space heating requirement in kWh/m²/year	16.98	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	304.95	240.06	245.3	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.95	0.97	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	290.8	233.13	235.24	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.76	635.66	565.27	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	274.29	299.49	245.54	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	819.32	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	58.51	63.88	52.38	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	174.77	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.6	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	140.52	105.89	79.22	34.67	11.99	0	0	0	0	40.31	90.55	142.4	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	82.66	62.29	46.6	20.39	7.06	0	0	0	0	23.71	53.26	83.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	379.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

127.99	112.51	117.44	104.28	101.46	89.62	85.08	94.73	94.99	108.18	115.64	124.58	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 127.99 | 112.51 | 117.44 | 104.28 | 101.46 | 89.62 | 85.08 | 94.73 | 94.99 | 108.18 | 115.64 | 124.58 |

Total = Sum(219a)$_{1...12}$ = 1276.49 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 10.89 | 11.89 | 9.75 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 32.53 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		379.73	
Water heating fuel used		1276.49	
Space cooling fuel used		32.53	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.71		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.71	(231)
Electricity for lighting		183.56	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1981.01	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	50.09	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.37	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.29	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.34	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.21	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				261.3	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.56	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	197.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =				859.58	(265)
Space cooling	(221) x		0.519	=	16.88	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.42	(267)
Electricity for lighting	(232) x		0.519	=	95.27	(268)
Total CO2, kg/year		sum of (265)…(271) =			1028.14	(272)
CO2 emissions per m²		(272) ÷ (4) =			27.04	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1165.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3918.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5084.58	(265)
Space cooling	(221) x		3.07	=	99.86	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.73	(267)
Electricity for lighting	(232) x		0	=	563.53	(268)
'Total Primary Energy		sum of (265)…(271) =			6081.7	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			159.96	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 17 Flat 17 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	38.02	(1a) x	2.7	(2a) =	102.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	38.02	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.19 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.44 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.51	x 1/[1/(1.5)+ 0.04] =	13.46			(27)
Floor			38.02	x 0.13 =	4.9426			(28)
Walls	21.12	9.51	11.61	x 0.18 =	2.09			(29)
Total area of elements, m²			59.14					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.23	x 0 =	0			(32)
Party ceiling			38.02					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3279.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.21	20.08	19.96	19.37	19.26	18.75	18.75	18.66	18.95	19.26	19.49	19.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	43.01	42.89	42.76	42.18	42.07	41.56	41.56	41.46	41.75	42.07	42.29	42.52	

Average = Sum(39)$_{1...12}$ /12= 42.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.09	1.09	1.09	1.1	1.11	1.11	1.12

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.38 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.01	70.36	67.7	65.05	62.39	59.74	59.74	62.39	65.05	67.7	70.36	73.01

Total = Sum(44)$_{1...12}$ = 796.51 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.28	94.7	97.72	85.2	81.75	70.54	65.37	75.01	75.91	88.46	96.56	104.86

Total = Sum(45)$_{1...12}$ = 1044.35 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.66	12.78	12.26	10.58	9.81	11.25	11.39	13.27	14.48	15.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.23	136.2	143.67	129.67	127.7	115.01	111.32	120.96	120.38	134.41	141.03	150.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.23	136.2	143.67	129.67	127.7	115.01	111.32	120.96	120.38	134.41	141.03	150.81	

Output from water heater (annual)$_{1...12}$ 1585.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.76	64.69	69.25	63.9	63.94	59.03	58.5	61.7	60.81	66.18	67.68	71.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	67.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.23	7.51	5.68	4.25	3.59	3.88	5.04	6.76	8.59	10.02	10.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.59	117.8	114.75	108.26	100.07	92.37	87.22	86.01	89.06	95.55	103.74	111.44	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	-54.19	(71)

Water heating gains (Table 5)

(72)m=	97.8	96.27	93.08	88.76	85.94	81.99	78.62	82.93	84.46	88.95	94	96.27	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	271.1	269.62	261.66	249.02	236.58	224.26	216.04	220.3	226.61	239.4	254.09	264.72	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.51	x	11.28	x	0.63	x	0.7	=	32.79	(81)
Northwest 0.9x	0.77	x	9.51	x	22.97	x	0.63	x	0.7	=	66.75	(81)
Northwest 0.9x	0.77	x	9.51	x	41.38	x	0.63	x	0.7	=	120.26	(81)
Northwest 0.9x	0.77	x	9.51	x	67.96	x	0.63	x	0.7	=	197.51	(81)
Northwest 0.9x	0.77	x	9.51	x	91.35	x	0.63	x	0.7	=	265.49	(81)

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Northwest	0.9x	0.77	x	9.51	x	97.38	x	0.63	x	0.7	=	283.04	(81)
Northwest	0.9x	0.77	x	9.51	x	91.1	x	0.63	x	0.7	=	264.77	(81)
Northwest	0.9x	0.77	x	9.51	x	72.63	x	0.63	x	0.7	=	211.08	(81)
Northwest	0.9x	0.77	x	9.51	x	50.42	x	0.63	x	0.7	=	146.54	(81)
Northwest	0.9x	0.77	x	9.51	x	28.07	x	0.63	x	0.7	=	81.57	(81)
Northwest	0.9x	0.77	x	9.51	x	14.2	x	0.63	x	0.7	=	41.26	(81)
Northwest	0.9x	0.77	x	9.51	x	9.21	x	0.63	x	0.7	=	26.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.79	66.75	120.26	197.51	265.49	283.04	264.77	211.08	146.54	81.57	41.26	26.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.9	336.37	381.92	446.52	502.07	507.3	480.82	431.39	373.15	320.98	295.35	291.5	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.89	0.72	0.52	0.38	0.44	0.71	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.11	20.38	20.72	20.92	20.99	21	21	20.95	20.66	20.26	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.86	0.66	0.44	0.29	0.35	0.63	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.62	18.83	19.21	19.68	19.93	20	20.01	20.01	19.96	19.62	19.06	18.6	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.28	19.46	19.79	20.19	20.42	20.49	20.49	20.49	20.45	20.13	19.65	19.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.28	19.46	19.79	20.19	20.42	20.49	20.49	20.49	20.45	20.13	19.65	19.26	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.34	0.39	0.67	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	300.37	329.62	363.92	385.69	344.14	241.83	161.47	168.97	250.4	293.95	288.82	288.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	644.47	624.43	568.09	476.24	366.8	244.64	161.83	169.75	265.05	401	530.77	640.34	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	256.02	198.11	151.9	65.2	16.86	0	0	0	0	79.64	174.21	261.62	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1203.56	(98)
Space heating requirement in kWh/m²/year	31.66	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
256.02	198.11	151.9	65.2	16.86	0	0	0	0	79.64	174.21	261.62	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
273.81	211.89	162.46	69.73	18.04	0	0	0	0	85.18	186.32	279.81	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1287.23 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.23	136.2	143.67	129.67	127.7	115.01	111.32	120.96	120.38	134.41	141.03	150.81

Efficiency of water heater 79.8 (216)

(217)m=	86.16	85.81	84.96	83.09	80.92	79.8	79.8	79.8	79.8	83.47	85.38	86.27	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	179.01	158.72	169.1	156.06	157.82	144.13	139.5	151.58	150.85	161.03	165.18	174.81

Total = Sum(219a)$_{1...12}$ = 1907.79 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1287.23
Water heating fuel used		1907.79
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.56 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3453.59 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	278.04	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	412.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			690.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.27	(268)
Total CO2, kg/year	sum of (265)…(271) =			824.32	(272)

TER = 31.66 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 17 Flat 17 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.5	**(P1)**
Transmission heat loss coefficient:	22.2	
Summer heat loss coefficient:	157.73	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.18	261.86	267.27	
Total summer gains	677.76	629.73	555.78	**(P5)**
Summer gain/loss ratio	4.3	3.99	3.52	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.3	21.69	21.12	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:26

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 77.97m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 18 Flat 18 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:18

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 18 Flat 18 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:10

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.98m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 18 Flat 18 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

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Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 18 Flat 18 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:35:02

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.59m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 18 Flat 18 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:34:54

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.7m²
Site Reference : P1785 St Michaels
Plot Reference: Level 18 Flat 18 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:34:47

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 18 Flat 18 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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Property Details: Level 18 Flat 18 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	Psi-value		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:34:38

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.48m²
Site Reference : P1785 St Michaels
Plot Reference: Level 18 Flat 18 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:34:29

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.4m²
Site Reference : P1785 St Michaels
Plot Reference: Level 18 Flat 18 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:34:22

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.9m²
Site Reference : P1785 St Michaels
Plot Reference: Level 18 Flat 18 09
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.83 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 18 Flat 18 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	Psi-value		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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TER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:34:14

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.58m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 18 Flat 18 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.87 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:34:06

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.6m²

Site Reference : P1785 St Michaels

Plot Reference: Level 18 Flat 18 11

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 18 Flat 18 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:59

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.96m²

Site Reference : P1785 St Michaels

Plot Reference: Level 18 Flat 18 12

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 18 Flat 18 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 18 Flat 18 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 18 Flat 18 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:32:07

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 77.97m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 19 Flat 19 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:59

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 19 Flat 19 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:51

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.98m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 19 Flat 19 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.83 kWh/day	**OK**

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Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 19 Flat 19 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:43

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.59m²
Site Reference : P1785 St Michaels
Plot Reference: Level 19 Flat 19 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

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Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:35

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.7m²

Site Reference : P1785 St Michaels

Plot Reference: Level 19 Flat 19 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:28

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.96m²

Site Reference : P1785 St Michaels

Plot Reference: Level 19 Flat 19 06

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 19 Flat 19 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	Psi-value		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:21

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.48m²
Site Reference : P1785 St Michaels
Plot Reference: Level 19 Flat 19 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:12

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.4m²
Site Reference : P1785 St Michaels
Plot Reference: Level 19 Flat 19 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:31:05

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.9m²

Site Reference : P1785 St Michaels

Plot Reference: Level 19 Flat 19 09

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.83 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 19 Flat 19 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	Psi-value		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9 (1a)	x	2.7 (2a)	=	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:55

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.58m²
Site Reference : P1785 St Michaels
Plot Reference: Level 19 Flat 19 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:48

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.6m²
Site Reference : P1785 St Michaels
Plot Reference: Level 19 Flat 19 11
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 19 Flat 19 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:40

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 19 Flat 19 12
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

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2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 19 Flat 19 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 19 Flat 19 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 19 Flat 19 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:34

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 77.97m²
Site Reference : P1785 St Michaels
Plot Reference: Level 20 Flat 20 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:27

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels
Plot Reference: Level 20 Flat 20 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:19

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.98m²
Site Reference : P1785 St Michaels
Plot Reference: Level 20 Flat 20 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 20 Flat 20 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:12

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.59m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 20 Flat 20 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.06 kWh/day	
	Permitted by DBSCG: 1.87 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:30:05

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.7m²

Site Reference : P1785 St Michaels

Plot Reference: Level 20 Flat 20 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:57

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels
Plot Reference: Level 20 Flat 20 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 20 Flat 20 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	Psi-value		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:50

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 86.48m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 20 Flat 20 07

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:42

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.4m²
Site Reference : P1785 St Michaels
Plot Reference: Level 20 Flat 20 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

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Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:35

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.9m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 20 Flat 20 09
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 20 Flat 20 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	Psi-value		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:28

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.58m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 20 Flat 20 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

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Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:20

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.6m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 20 Flat 20 11
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 20 Flat 20 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:12

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 20 Flat 20 12
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 20 Flat 20 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 20 Flat 20 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 20 Flat 20 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:29:04

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 77.97m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 21 Flat 21 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:57

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 21 Flat 21 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:48

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.98m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 21 Flat 21 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:40

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.59m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:32

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.7m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:25

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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Property Details: Level 21 Flat 21 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	Psi-value		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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Assess Zero Carbon Home: No

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:17

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.48m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:08

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.4m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:28:01

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.9m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 09
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 21 Flat 21 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	Psi-value		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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TER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:54

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.58m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:46

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.6m²
Site Reference : P1785 St Michaels
Plot Reference: Level 21 Flat 21 11
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 21 Flat 21 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:39

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 21 Flat 21 12
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 21 Flat 21 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 21 Flat 21 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 21 Flat 21 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:32

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 77.97m²
Site Reference : P1785 St Michaels
Plot Reference: Level 22 Flat 22 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:24

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels
Plot Reference: Level 22 Flat 22 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:16

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.98m²
Site Reference : P1785 St Michaels
Plot Reference: Level 22 Flat 22 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

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2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 22 Flat 22 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:09

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.59m²

Site Reference : P1785 St Michaels

Plot Reference: Level 22 Flat 22 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:27:02

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.7m²

Site Reference : P1785 St Michaels

Plot Reference: Level 22 Flat 22 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:55

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.96m²

Site Reference : P1785 St Michaels

Plot Reference: Level 22 Flat 22 06

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 22 Flat 22 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	Psi-value		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:47

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 86.48m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 22 Flat 22 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m
Living area:	42.37 m² (fraction 0.49)	
Front of dwelling faces:	North	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:39

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 86.4m²

Site Reference : P1785 St Michaels

Plot Reference: Level 22 Flat 22 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:31

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.9m²

Site Reference : P1785 St Michaels

Plot Reference: Level 22 Flat 22 09

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 22 Flat 22 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	**Psi-value**		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9 (1a)	x	2.7 (2a)	=	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:24

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.58m²
Site Reference : P1785 St Michaels
Plot Reference: Level 22 Flat 22 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:16

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.6m²

Site Reference : P1785 St Michaels

Plot Reference: Level 22 Flat 22 11

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 22 Flat 22 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:08

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.96m²

Site Reference : P1785 St Michaels

Plot Reference: Level 22 Flat 22 12

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 22 Flat 22 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 22 Flat 22 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 22 Flat 22 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:26:00

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 77.97m²

Site Reference : P1785 St Michaels

Plot Reference: Level 23 Flat 23 01

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:52

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels
Plot Reference: Level 23 Flat 23 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:44

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.98m²

Site Reference : P1785 St Michaels

Plot Reference: Level 23 Flat 23 03

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 23 Flat 23 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.34 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:37

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.59m²
Site Reference : P1785 St Michaels
Plot Reference: Level 23 Flat 23 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:30

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.7m²

Site Reference : P1785 St Michaels

Plot Reference: Level 23 Flat 23 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:23

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels
Plot Reference: Level 23 Flat 23 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 23 Flat 23 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	Psi-value		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96 (1a)	x	2.7 (2a)	=	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:16

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.48m²
Site Reference : P1785 St Michaels
Plot Reference: Level 23 Flat 23 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m
Living area:	42.37 m² (fraction 0.49)	
Front of dwelling faces:	North	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:09

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 86.4m²
Site Reference : P1785 St Michaels
Plot Reference: Level 23 Flat 23 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:25:02

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.9m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 23 Flat 23 09
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 23 Flat 23 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	**Psi-value**		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:24:55

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.58m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 23 Flat 23 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:24:47

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.6m²

Site Reference : P1785 St Michaels

Plot Reference: Level 23 Flat 23 11

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 23 Flat 23 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:24:37

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 23 Flat 23 12
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 23 Flat 23 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 23 Flat 23 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 23 Flat 23 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:24:30

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 77.97m²
Site Reference : P1785 St Michaels
Plot Reference: Level 24 Flat 24 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

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Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:24:21

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels
Plot Reference: Level 24 Flat 24 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:24:12

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.98m²
Site Reference : P1785 St Michaels
Plot Reference: Level 24 Flat 24 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

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2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 24 Flat 24 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:24:05

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.59m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 24 Flat 24 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:56

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.7m²

Site Reference : P1785 St Michaels

Plot Reference: Level 24 Flat 24 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:48

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels
Plot Reference: Level 24 Flat 24 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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Property Details: Level 24 Flat 24 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	Psi-value		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:42

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 86.48m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 24 Flat 24 07

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m
Living area:	42.37 m² (fraction 0.49)	
Front of dwelling faces:	North	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:34

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 86.4m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 24 Flat 24 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:27

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.9m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 24 Flat 24 09
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 24 Flat 24 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	Psi-value		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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TER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:19

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.58m²
Site Reference : P1785 St Michaels
Plot Reference: Level 24 Flat 24 10
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:11

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.6m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 24 Flat 24 11
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 24 Flat 24 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:23:04

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.96m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 24 Flat 24 12

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 24 Flat 24 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 24 Flat 24 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 24 Flat 24 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:56

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 77.97m²
Site Reference : P1785 St Michaels
Plot Reference: Level 25 Flat 25 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.99 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	19.16m²
Windows facing: West	6.79m²
Windows facing: North	11.45m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	77.97 m²	2.7 m

Living area:	38.91 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N CURT WALL	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW CURT WALL	16mm or more	0.8	0.4	1	19.16	1
W CURT WALL	16mm or more	1	0.4	1	6.79	1
N CURT WALL	16mm or more	1	0.4	1	11.45	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW CURT WALL		OPAQUE CURT WALL	North West	0	0
W CURT WALL		OPAQUE CURT WALL	West	0	0
N CURT WALL		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.96	7.47	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.97						N/A
PARTY CEILING	77.97						N/A

SAP Input

PARTY FLOOR 77.97 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.37 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.45	x 1/[1/(1)+ 0.04]		=	11.01			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.43	39.96	7.47	x	0.24	=	1.79			(29)
Total area of elements, m²			47.43							(31)
Party wall			50.74	x	0	=	0			(32)
Party wall			12.97	x	0	=	0			(32)
Party floor			77.97							(32a)
Party ceiling			77.97							(32b)
Internal wall **			115.56							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16453.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.89 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.99	26.62	26.25	24.4	24.03	22.19	22.19	21.82	22.93	24.03	24.77	25.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	70.87	70.51	70.14	68.29	67.92	66.08	66.08	65.71	66.81	67.92	68.66	69.4	

Average = Sum(39)$_{1...12}$ /12= 68.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.88	0.87	0.85	0.85	0.84	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89	

Output from water heater (annual)$_{1...12}$ — 1796.2 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.72	65.16	68.87	62.34	61.53	55.61	54	58.43	58.07	64.61	67.57	72.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	145.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.95	42.59	34.64	26.22	19.6	16.55	17.88	23.24	31.2	39.61	46.23	49.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.11	324.44	316.05	298.17	275.61	254.4	240.23	236.9	245.3	263.17	285.74	306.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	51.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	99.09	96.97	92.57	86.59	82.7	77.23	72.58	78.54	80.65	86.85	93.84	96.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.58	564.43	543.68	511.41	478.34	448.6	431.12	439.11	457.57	490.06	526.23	553.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.45	x	10.63	x	0.4	x	1	=	33.75	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.45	x	20.32	x	0.4	x	1	=	64.5	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.45	x	34.53	x	0.4	x	1	=	109.6	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.45	x	55.46	x	0.4	x	1	=	176.04	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.45	x	74.72	x	0.4	x	1	=	237.14	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.45	x	79.99	x	0.4	x	1	=	253.87	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.45	x	74.68	x	0.4	x	1	=	237.02	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.45	x	59.25	x	0.4	x	1	=	188.04	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.45	x	41.52	x	0.4	x	1	=	131.77	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.45	x	24.19	x	0.4	x	1	=	76.78	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.45	x	13.12	x	0.4	x	1	=	41.63	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.45	x	8.86	x	0.4	x	1	=	28.14	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	19.16	x	11.28	x	0.4	x	0.8	=	47.94	(81)
Northwest	0.9x	0.77	x	19.16	x	22.97	x	0.4	x	0.8	=	97.58	(81)
Northwest	0.9x	0.77	x	19.16	x	41.38	x	0.4	x	0.8	=	175.82	(81)
Northwest	0.9x	0.77	x	19.16	x	67.96	x	0.4	x	0.8	=	288.74	(81)
Northwest	0.9x	0.77	x	19.16	x	91.35	x	0.4	x	0.8	=	388.12	(81)

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Northwest	0.9x	0.77	x	19.16	x	97.38	x	0.4	x	0.8	=	413.78	(81)
Northwest	0.9x	0.77	x	19.16	x	91.1	x	0.4	x	0.8	=	387.08	(81)
Northwest	0.9x	0.77	x	19.16	x	72.63	x	0.4	x	0.8	=	308.59	(81)
Northwest	0.9x	0.77	x	19.16	x	50.42	x	0.4	x	0.8	=	214.23	(81)
Northwest	0.9x	0.77	x	19.16	x	28.07	x	0.4	x	0.8	=	119.26	(81)
Northwest	0.9x	0.77	x	19.16	x	14.2	x	0.4	x	0.8	=	60.32	(81)
Northwest	0.9x	0.77	x	19.16	x	9.21	x	0.4	x	0.8	=	39.15	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.94	244.49	421.66	666.02	875.24	925.28	868.65	704.26	505.14	293.85	154.57	102.09	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.52	808.92	965.34	1177.43	1353.58	1373.89	1299.77	1143.36	962.71	783.91	680.8	655.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.61	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.63	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.19	20.19	20.21	20.21	20.22	20.2	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.73	19.31	19.87	20.1	20.2	20.21	20.21	20.14	19.76	19	18.28	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.97	672.45	715.27	689.5	571.43	390.34	263.07	273.78	410.95	536.09	567.92	584.16	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1039.36	1016.54	933.78	778.4	598.39	395.71	264.39	276.01	430.29	651.86	853.95	1022.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1416.09	(98)
Space heating requirement in kWh/m²/year	18.16	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	621.12	488.97	499.38	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	599.74	478.63	483.49	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1530.1	1446.42	1262.26	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.86	720.04	579.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1969.31	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.11	146.3	117.73	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	400.14	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.13	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	320.21	231.23	162.57	64	20.06	0	0	0	0	86.14	205.94	325.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	188.36	136.02	95.63	37.65	11.8	0	0	0	0	50.67	121.14	191.73	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	832.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.62	157.95	165.03	146.75	142.95	126.49	120.3	133.63	133.9	152.23	162.46	174.89

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.62 | 157.95 | 165.03 | 146.75 | 142.95 | 126.49 | 120.3 | 133.63 | 133.9 | 152.23 | 162.46 | 174.89 |

Total = Sum(219a)$_{1...12}$ = 1796.2 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.33 | 27.23 | 21.91 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.47 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		832.99
Water heating fuel used		1796.2
Space cooling fuel used		74.47
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	199.05	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		199.05 (231)
Electricity for lighting		338.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3241.44 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.87	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.92	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.82	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	26.25	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.68	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				427.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.63	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	432.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	932.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1364.55	(265)
Space cooling	(221)	x	0.519	=	38.65	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	103.3	(267)
Electricity for lighting	(232)	x	0.519	=	175.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1682.31	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.58	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2557.29	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5514.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8071.61	(265)
Space cooling	(221)	x	3.07	=	228.63	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	611.07	(267)
Electricity for lighting	(232)	x	0	=	1039.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9951.22	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			127.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.97	(1a) x	2.7	(2a) =	210.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.31	x1/[1/(1.5)+ 0.04] =	4.68			(27)
Windows Type 3			5.59	x1/[1/(1.5)+ 0.04] =	7.91			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.97	x 0 =	0			(32)
Party floor			77.97					(32a)
Party ceiling			77.97					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16739.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.19 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.02	40.78	40.54	39.41	39.2	38.23	38.23	38.04	38.6	39.2	39.63	40.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.21	76.97	76.73	75.6	75.39	74.42	74.42	74.23	74.79	75.39	75.82	76.26	

Average = Sum(39)$_{1...12}$ /12= 75.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.99	0.99	0.98	0.97	0.97	0.95	0.95	0.95	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.93	97.26	93.59	89.92	86.25	82.58	82.58	86.25	89.92	93.59	97.26	100.93	

Total = Sum(44)$_{1...12}$ = 1101.02 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.67	130.9	135.08	117.77	113	97.51	90.36	103.69	104.92	122.28	133.48	144.95	

Total = Sum(45)$_{1...12}$ = 1443.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.45	19.64	20.26	17.66	16.95	14.63	13.55	15.55	15.74	18.34	20.02	21.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04	

Output from water heater (annual)$_{1...12}$ — 2033.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.84	79.72	84.99	77.94	77.65	71.2	70.12	74.55	73.67	80.73	83.16	88.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	121.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.18	17.04	13.85	10.49	7.84	6.62	7.15	9.3	12.48	15.84	18.49	19.71	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.15	217.38	211.75	199.78	184.66	170.45	160.95	158.72	164.35	176.32	191.44	205.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	-96.93	(71)

Water heating gains (Table 5)

(72)m=	120.75	118.63	114.23	108.25	104.36	98.89	94.24	100.2	102.32	108.51	115.5	118.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.43	415.39	402.19	380.86	359.21	338.31	324.7	330.57	341.49	363.03	387.79	406.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.59	x	10.63	x	0.63	x	0.7	=	18.17	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.59	x	20.32	x	0.63	x	0.7	=	34.72	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.59	x	34.53	x	0.63	x	0.7	=	58.99	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.59	x	55.46	x	0.63	x	0.7	=	94.75	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.59	x	74.72	x	0.63	x	0.7	=	127.64	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.59	x	79.99	x	0.63	x	0.7	=	136.65	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.59	x	74.68	x	0.63	x	0.7	=	127.58	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.59	x	59.25	x	0.63	x	0.7	=	101.22	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.59	x	41.52	x	0.63	x	0.7	=	70.93	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.59	x	24.19	x	0.63	x	0.7	=	41.32	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.59	x	13.12	x	0.63	x	0.7	=	22.41	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.59	x	8.86	x	0.63	x	0.7	=	15.14	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
West	0.9x	0.77	x	3.31	x	19.64	x	0.63	x	0.7	=	19.87	(80)
West	0.9x	0.77	x	3.31	x	38.42	x	0.63	x	0.7	=	38.87	(80)
West	0.9x	0.77	x	3.31	x	63.27	x	0.63	x	0.7	=	64.01	(80)
West	0.9x	0.77	x	3.31	x	92.28	x	0.63	x	0.7	=	93.35	(80)
West	0.9x	0.77	x	3.31	x	113.09	x	0.63	x	0.7	=	114.4	(80)
West	0.9x	0.77	x	3.31	x	115.77	x	0.63	x	0.7	=	117.11	(80)
West	0.9x	0.77	x	3.31	x	110.22	x	0.63	x	0.7	=	111.49	(80)
West	0.9x	0.77	x	3.31	x	94.68	x	0.63	x	0.7	=	95.77	(80)
West	0.9x	0.77	x	3.31	x	73.59	x	0.63	x	0.7	=	74.44	(80)
West	0.9x	0.77	x	3.31	x	45.59	x	0.63	x	0.7	=	46.12	(80)
West	0.9x	0.77	x	3.31	x	24.49	x	0.63	x	0.7	=	24.77	(80)
West	0.9x	0.77	x	3.31	x	16.15	x	0.63	x	0.7	=	16.34	(80)
Northwest	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(81)
Northwest	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(81)
Northwest	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(81)
Northwest	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(81)

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Northwest	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(81)
Northwest	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(81)
Northwest	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(81)
Northwest	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(81)
Northwest	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(81)
Northwest	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(81)
Northwest	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.34	146.97	254.43	403.47	531.61	562.59	527.92	427.15	305.3	176.88	92.76	61.2	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.76	562.37	656.61	784.33	890.81	900.89	852.62	757.72	646.79	539.91	480.55	467.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.98	19.36	19.83	20.06	20.12	20.12	20.12	20.08	19.73	19.18	18.74	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.57	19.89	20.29	20.5	20.55	20.56	20.56	20.52	20.2	19.73	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.35	0.41	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.63	556.96	637.2	697.28	627.88	439.53	294.25	307.82	455.03	510.78	475.99	466	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1164.85	1128.94	1027.2	860.91	663.46	443.1	294.63	308.77	480.11	723.79	957.53	1156.44	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2340.05	(98)
Space heating requirement in kWh/m²/year	30.01	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
502.37	384.37	290.16	117.81	26.47	0	0	0	0	158.48	346.71	513.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
537.29	411.09	310.33	126	28.31	0	0	0	0	169.5	370.81	549.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2502.73	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	199.76	176.15	185.17	166.24	163.09	145.99	140.45	153.78	153.4	172.37	181.95	195.04

Efficiency of water heater	79.8	(216)

(217)m=	87.17	86.84	86.01	83.91	81.14	79.8	79.8	79.8	79.8	84.59	86.51	87.28	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.15	202.84	215.3	198.11	201	182.94	176	192.7	192.23	203.77	210.33	223.47	

Total = Sum(219a)$_{1...12}$ =	2427.85	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2502.73	
Water heating fuel used		2427.85	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5344.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	540.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	524.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1279.73	(272)

TER = 23.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	277.89	**(P1)**
Transmission heat loss coefficient:	43.9	
Summer heat loss coefficient:	321.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW CURT WALL)	0	1
West (W CURT WALL)	0	1
North (N CURT WALL)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW CURT WALL)	1	0.9	1	0.9	**(P8)**
West (W CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N CURT WALL)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW CURT WALL)	0.9 x	19.16	89.66	0.4	0.8	0.9	445.25	
West (W CURT WALL)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N CURT WALL)	0.9 x	11.45	73.49	0.4	1	0.9	272.64	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	999.19	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.6	431.12	439.11	
Total summer gains	1546.32	1430.31	1236.05	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:47

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 78.01m²
Site Reference : P1785 St Michaels
Plot Reference: Level 25 Flat 25 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.23 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	40.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	19.14m²
Windows facing: East	6.79m²
Windows facing: North	11.42m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	78.01 m²	2.7 m

Living area:	38.93 m² (fraction 0.499)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	19.14	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.42	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.43	39.91	7.52	0.24	0	True	N/A
Internal Elements							
INT WALLS	115.56						N/A
Party Elements							
PARTY WALLS	50.74						N/A
WALLS TO CORRIDOR	12.96						N/A
PARTY CEILING	78.01						N/A

SAP Input

PARTY FLOOR 78.01 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.18	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 63.02 (fraction 0.808)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.39	0.38	0.36	0.35	0.32	0.32	0.32	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.14	x 1/[1/(1)+ 0.04] =	18.4			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04] =	6.53			(27)
Windows Type 3			11.42	x 1/[1/(1)+ 0.04] =	10.98			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04] =	2.46			(27)
Walls	47.43	39.91	7.52	x 0.24 =	1.8			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16461.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.45 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	26.93	26.56	24.71	24.34	22.49	22.49	22.12	23.23	24.34	25.08	25.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.74	70.37	70	68.16	67.79	65.94	65.94	65.57	66.68	67.79	68.53	69.26	

Average = Sum(39)$_{1...12}$ /12= 68.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.87	0.87	0.85	0.85	0.84	0.85	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92	

Output from water heater (annual)$_{1...12}$ — 1796.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.73	65.17	68.88	62.35	61.54	55.61	54.01	58.44	58.08	64.62	67.57	72.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	145.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	47.97	42.61	34.65	26.23	19.61	16.55	17.89	23.25	31.21	39.63	46.25	49.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	321.24	324.57	316.17	298.29	275.72	254.5	240.33	236.99	245.39	263.28	285.85	307.07	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	51.97	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	99.1	96.98	92.58	86.6	82.71	77.24	72.59	78.55	80.66	86.86	93.85	96.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	568.76	564.61	543.85	511.57	478.48	448.74	431.25	439.24	457.71	490.21	526.4	553.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.42	x	10.63	x	0.4	x	1	=	33.66	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	11.42	x	20.32	x	0.4	x	1	=	64.33	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	11.42	x	34.53	x	0.4	x	1	=	109.31	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	11.42	x	55.46	x	0.4	x	1	=	175.58	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	11.42	x	74.72	x	0.4	x	1	=	236.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	11.42	x	79.99	x	0.4	x	1	=	253.2	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	11.42	x	74.68	x	0.4	x	1	=	236.4	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	11.42	x	59.25	x	0.4	x	1	=	187.55	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	11.42	x	41.52	x	0.4	x	1	=	131.43	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	11.42	x	24.19	x	0.4	x	1	=	76.57	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	11.42	x	13.12	x	0.4	x	1	=	41.53	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	11.42	x	8.86	x	0.4	x	1	=	28.06	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Northeast	0.9x	0.77	x	19.14	x	11.28	x	0.4	x	0.8	=	47.89	(75)
Northeast	0.9x	0.77	x	19.14	x	22.97	x	0.4	x	0.8	=	97.48	(75)
Northeast	0.9x	0.77	x	19.14	x	41.38	x	0.4	x	0.8	=	175.63	(75)
Northeast	0.9x	0.77	x	19.14	x	67.96	x	0.4	x	0.8	=	288.44	(75)
Northeast	0.9x	0.77	x	19.14	x	91.35	x	0.4	x	0.8	=	387.72	(75)
Northeast	0.9x	0.77	x	19.14	x	97.38	x	0.4	x	0.8	=	413.35	(75)
Northeast	0.9x	0.77	x	19.14	x	91.1	x	0.4	x	0.8	=	386.68	(75)
Northeast	0.9x	0.77	x	19.14	x	72.63	x	0.4	x	0.8	=	308.26	(75)
Northeast	0.9x	0.77	x	19.14	x	50.42	x	0.4	x	0.8	=	214.01	(75)
Northeast	0.9x	0.77	x	19.14	x	28.07	x	0.4	x	0.8	=	119.13	(75)
Northeast	0.9x	0.77	x	19.14	x	14.2	x	0.4	x	0.8	=	60.26	(75)
Northeast	0.9x	0.77	x	19.14	x	9.21	x	0.4	x	0.8	=	39.11	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.8	244.22	421.19	665.26	874.21	924.18	867.62	703.44	504.57	293.53	154.39	101.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	692.56	808.83	965.04	1176.83	1352.7	1372.93	1298.87	1142.68	962.28	783.74	680.79	655.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.86	0.77	0.61	0.44	0.3	0.22	0.26	0.45	0.72	0.87	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.91	20.32	20.73	20.92	20.98	21	20.99	20.94	20.64	20.08	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.22	20.21	20.19	20.19	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.85	0.75	0.58	0.41	0.27	0.18	0.22	0.41	0.68	0.85	0.91	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.74	19.32	19.87	20.11	20.2	20.21	20.21	20.15	19.77	19.01	18.29	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.97	19.32	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.54	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.88	0.83	0.74	0.59	0.42	0.28	0.2	0.24	0.43	0.68	0.83	0.89	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	608.96	672.29	714.87	688.78	570.61	389.67	262.61	273.3	410.37	535.72	567.82	584.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1037.88	1015.04	932.34	777.07	597.32	394.98	263.92	275.5	429.53	650.8	852.66	1020.76	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1410.21	(98)
Space heating requirement in kWh/m²/year	18.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	619.85	487.96	498.35	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	598.69	477.75	482.64	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1528.96	1445.36	1261.45	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	669.79	719.9	579.43	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	1969.13	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.27	145.39	117.02	0	0	0	0	

Total = Sum(107)$_{5...8}$ =	397.69	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.1	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	319.12	230.33	161.79	63.57	19.88	0	0	0	0	85.62	205.09	324.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	187.72	135.49	95.17	37.39	11.69	0	0	0	0	50.37	120.64	191.07	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	829.54	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

179.65	157.98	165.05	146.77	142.97	126.51	120.32	133.65	133.93	152.25	162.49	174.92

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 179.65 | 157.98 | 165.05 | 146.77 | 142.97 | 126.51 | 120.32 | 133.65 | 133.93 | 152.25 | 162.49 | 174.92 |

Total = Sum(219a)$_{1...12}$ = 1796.5 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.18 | 27.06 | 21.78 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.02 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		829.54	
Water heating fuel used		1796.5	
Space cooling fuel used		74.02	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	241.03	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3279.95	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	109.42	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	236.96	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.76	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	31.79	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	44.7	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				432.62	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.48	(257)
SAP rating (Section 12)		79.39	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	430.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	932.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1362.91	(265)
Space cooling	(221) x		0.519	=	38.41	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	125.1	(267)
Electricity for lighting	(232) x		0.519	=	175.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1702.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			21.82	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2546.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5515.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8061.92	(265)
Space cooling	(221) x		3.07	=	227.23	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	739.97	(267)
Electricity for lighting	(232) x		0	=	1040.32	(268)
'Total Primary Energy		sum of (265)…(271) =			10069.44	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			129.08	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.01	(1a) x	2.7	(2a) =	210.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		210.63	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.35	x1/[1/(1.5)+ 0.04] =	13.23			(27)
Windows Type 2			3.32	x1/[1/(1.5)+ 0.04] =	4.7			(27)
Windows Type 3			5.58	x1/[1/(1.5)+ 0.04] =	7.9			(27)
Windows Type 4			1.25	x1/[1/(1.5)+ 0.04] =	1.77			(27)
Walls	47.43	19.5	27.93	x 0.18 =	5.03			(29)
Total area of elements, m²			47.43					(31)
Party wall			50.74	x 0 =	0			(32)
Party wall			12.96	x 0 =	0			(32)
Party floor			78.01					(32a)
Party ceiling			78.01					(32b)
Internal wall **			115.56					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.62 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16746.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.04	40.8	40.56	39.43	39.22	38.24	38.24	38.06	38.62	39.22	39.65	40.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.82	76.58	76.34	75.22	75.01	74.03	74.03	73.85	74.41	75.01	75.43	75.88	

Average = Sum(39)$_{1...12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.77 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.95	97.28	93.61	89.94	86.26	82.59	82.59	86.26	89.94	93.61	97.28	100.95	

Total = Sum(44)$_{1...12}$ = 1101.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	149.7	130.93	135.11	117.79	113.02	97.53	90.38	103.71	104.95	122.31	133.51	144.98	

Total = Sum(45)$_{1...12}$ = 1443.91 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.46	19.64	20.27	17.67	16.95	14.63	13.56	15.56	15.74	18.35	20.03	21.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07	

Output from water heater (annual)$_{1...12}$ — 2033.7 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	89.85	79.73	85	77.95	77.65	71.21	70.12	74.56	73.68	80.74	83.17	88.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.19	17.04	13.86	10.49	7.84	6.62	7.16	9.3	12.48	15.85	18.5	19.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.23	217.46	211.84	199.85	184.73	170.51	161.02	158.78	164.41	176.39	191.52	205.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	35.12	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	-96.96	(71)

Water heating gains (Table 5)

(72)m=	120.77	118.65	114.24	108.26	104.37	98.9	94.25	100.21	102.33	108.52	115.52	118.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.54	415.51	402.3	380.97	359.31	338.4	324.79	330.66	341.58	363.13	387.9	406.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	5.58	x	10.63	x	0.63	x	0.7	=	18.13	(74)
North	0.9x	0.77	x	1.25	x	10.63	x	0.63	x	0.7	=	4.06	(74)
North	0.9x	0.77	x	5.58	x	20.32	x	0.63	x	0.7	=	34.65	(74)
North	0.9x	0.77	x	1.25	x	20.32	x	0.63	x	0.7	=	7.76	(74)
North	0.9x	0.77	x	5.58	x	34.53	x	0.63	x	0.7	=	58.89	(74)
North	0.9x	0.77	x	1.25	x	34.53	x	0.63	x	0.7	=	13.19	(74)
North	0.9x	0.77	x	5.58	x	55.46	x	0.63	x	0.7	=	94.58	(74)
North	0.9x	0.77	x	1.25	x	55.46	x	0.63	x	0.7	=	21.19	(74)
North	0.9x	0.77	x	5.58	x	74.72	x	0.63	x	0.7	=	127.41	(74)
North	0.9x	0.77	x	1.25	x	74.72	x	0.63	x	0.7	=	28.54	(74)
North	0.9x	0.77	x	5.58	x	79.99	x	0.63	x	0.7	=	136.4	(74)
North	0.9x	0.77	x	1.25	x	79.99	x	0.63	x	0.7	=	30.56	(74)
North	0.9x	0.77	x	5.58	x	74.68	x	0.63	x	0.7	=	127.35	(74)
North	0.9x	0.77	x	1.25	x	74.68	x	0.63	x	0.7	=	28.53	(74)
North	0.9x	0.77	x	5.58	x	59.25	x	0.63	x	0.7	=	101.03	(74)
North	0.9x	0.77	x	1.25	x	59.25	x	0.63	x	0.7	=	22.63	(74)
North	0.9x	0.77	x	5.58	x	41.52	x	0.63	x	0.7	=	70.8	(74)
North	0.9x	0.77	x	1.25	x	41.52	x	0.63	x	0.7	=	15.86	(74)
North	0.9x	0.77	x	5.58	x	24.19	x	0.63	x	0.7	=	41.25	(74)
North	0.9x	0.77	x	1.25	x	24.19	x	0.63	x	0.7	=	9.24	(74)
North	0.9x	0.77	x	5.58	x	13.12	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.25	x	13.12	x	0.63	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	5.58	x	8.86	x	0.63	x	0.7	=	15.12	(74)
North	0.9x	0.77	x	1.25	x	8.86	x	0.63	x	0.7	=	3.39	(74)
Northeast	0.9x	0.77	x	9.35	x	11.28	x	0.63	x	0.7	=	32.24	(75)
Northeast	0.9x	0.77	x	9.35	x	22.97	x	0.63	x	0.7	=	65.63	(75)
Northeast	0.9x	0.77	x	9.35	x	41.38	x	0.63	x	0.7	=	118.24	(75)
Northeast	0.9x	0.77	x	9.35	x	67.96	x	0.63	x	0.7	=	194.18	(75)
Northeast	0.9x	0.77	x	9.35	x	91.35	x	0.63	x	0.7	=	261.02	(75)
Northeast	0.9x	0.77	x	9.35	x	97.38	x	0.63	x	0.7	=	278.27	(75)
Northeast	0.9x	0.77	x	9.35	x	91.1	x	0.63	x	0.7	=	260.32	(75)
Northeast	0.9x	0.77	x	9.35	x	72.63	x	0.63	x	0.7	=	207.53	(75)
Northeast	0.9x	0.77	x	9.35	x	50.42	x	0.63	x	0.7	=	144.08	(75)
Northeast	0.9x	0.77	x	9.35	x	28.07	x	0.63	x	0.7	=	80.2	(75)
Northeast	0.9x	0.77	x	9.35	x	14.2	x	0.63	x	0.7	=	40.57	(75)
Northeast	0.9x	0.77	x	9.35	x	9.21	x	0.63	x	0.7	=	26.33	(75)
East	0.9x	0.77	x	3.32	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	3.32	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	3.32	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	3.32	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	3.32	x	113.09	x	0.63	x	0.7	=	114.75	(76)

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East	0.9x	0.77	x	3.32	x	115.77	x	0.63	x	0.7	=	117.46		(76)
East	0.9x	0.77	x	3.32	x	110.22	x	0.63	x	0.7	=	111.83		(76)
East	0.9x	0.77	x	3.32	x	94.68	x	0.63	x	0.7	=	96.06		(76)
East	0.9x	0.77	x	3.32	x	73.59	x	0.63	x	0.7	=	74.67		(76)
East	0.9x	0.77	x	3.32	x	45.59	x	0.63	x	0.7	=	46.26		(76)
East	0.9x	0.77	x	3.32	x	24.49	x	0.63	x	0.7	=	24.85		(76)
East	0.9x	0.77	x	3.32	x	16.15	x	0.63	x	0.7	=	16.39		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	74.36	147.03	254.51	403.59	531.72	562.7	528.03	427.26	305.4	176.95	92.8	61.22	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.91	562.54	656.81	784.55	891.03	901.09	852.81	757.91	646.99	540.08	480.69	467.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.91	0.73	0.52	0.38	0.45	0.74	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.16	20.42	20.75	20.94	20.99	21	21	20.96	20.67	20.29	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.45	0.31	0.36	0.67	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.78	19	19.37	19.84	20.07	20.12	20.13	20.13	20.09	19.74	19.19	18.76	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.58	19.9	20.29	20.5	20.56	20.56	20.56	20.52	20.21	19.74	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.89	0.7	0.49	0.34	0.4	0.7	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	489.77	557.11	637.25	696.59	625.95	437.59	292.91	306.43	453.64	510.66	476.12	466.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1159.87	1124.09	1022.78	857.06	660.35	440.99	293.27	307.33	477.89	720.63	953.37	1151.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2317.21	(98)
Space heating requirement in kWh/m²/year	29.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	498.55	381.01	286.83	115.54	25.6	0	0	0	0	156.22	343.62	509.85	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	533.21	407.5	306.77	123.57	27.38	0	0	0	0	167.08	367.51	545.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	2478.3	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
199.79	176.17	185.2	166.27	163.11	146.01	140.47	153.8	153.42	172.4	181.98	195.07

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.16	86.82	85.98	83.87	81.1	79.8	79.8	79.8	79.8	84.55	86.48	87.26	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	229.24	202.92	215.41	198.25	201.13	182.97	176.03	192.73	192.26	203.89	210.42	223.55

Total = Sum(219a)$_{1...12}$ =	2428.78	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2478.3	
Water heating fuel used		2428.78	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		338.87	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.95	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211)	x	0.216	=	535.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1059.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	175.87	(268)
Total CO2, kg/year			sum of (265)…(271) =		1274.73	(272)

TER = 23.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	278.03	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	321.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	19.14	89.66	0.4	0.8	0.9	444.79	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.42	73.49	0.4	1	0.9	271.92	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	998.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	448.74	431.25	439.24	
Total summer gains	1545.16	1429.26	1235.26	**(P5)**
Summer gain/loss ratio	4.81	4.45	3.84	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.15	21.44	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:39

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.98m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 25 Flat 25 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.2 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.39 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 25 Flat 25 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.98 m²	2.7 m

Living area:	18.69 m² (fraction 0.492)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
NE	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	15.83	5.28	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	38.16						N/A
WALLS TO CORRIDOR	14.07						N/A
PARTY CEILING	37.98						N/A
PARTY FLOOR	37.98						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1096

	Length	Psi-value		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.81	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.4 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.11	15.83	5.28	x	0.24	=	1.27			(29)
Total area of elements, m²			21.11							(31)
Party wall			38.16	x	0	=	0			(32)
Party wall			14.07	x	0	=	0			(32)
Party floor			37.98							(32a)
Party ceiling			37.98							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8382.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.34	12.17	12.01	11.19	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.14	30.97	30.81	29.99	29.83	29.01	29.01	28.84	29.33	29.83	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54	

Output from water heater (annual)$_{1...12}$ 1276.11 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.18	47.36	50.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	81.22	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.96	23.06	18.75	14.2	10.61	8.96	9.68	12.58	16.89	21.45	25.03	26.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.86	175.67	171.12	161.44	149.22	137.74	130.07	128.27	132.81	142.49	154.71	166.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	44.48	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	69.57	68.04	64.86	60.53	57.72	53.76	50.4	54.71	56.24	60.72	65.78	68.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.95	338.32	326.28	307.72	289.11	272.02	261.71	267.11	277.5	296.21	317.07	332.47	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(75)
Northeast 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(75)
Northeast 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(75)
Northeast 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(75)
Northeast 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(75)

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Northeast	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(75)
Northeast	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(75)
Northeast	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(75)
Northeast	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(75)
Northeast	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(75)
Northeast	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(75)
Northeast	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.56	418.94	471.54	546.28	609.78	613.88	581.51	522.07	454.5	394.74	366.91	364.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.76	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.29	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.54	334.58	338.36	313.42	255.11	173.08	116.63	121.5	184.59	253.72	289.16	310.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.46	457.82	417.16	345.04	264.41	174.78	117.02	122.13	190.48	291.14	385.79	464.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.01	(98)
Space heating requirement in kWh/m²/year	13.06	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.66	214.65	219.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.13	211.16	213.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.6	635.51	565.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.66	315.71	261.26	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.63	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.42	67.33	55.72	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.47	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.03	82.82	58.63	22.77	6.92	0	0	0	0	27.84	69.57	114.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.49	48.72	34.49	13.39	4.07	0	0	0	0	16.38	40.93	67.31	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.77	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.95	112.47	117.4	104.24	101.43	89.6	85.06	94.7	94.96	108.14	115.61	124.54

Total = Sum(219a)$_{1...12}$ = 1276.11 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.62	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.52 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.77	
Water heating fuel used		1276.11	
Space cooling fuel used		34.52	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.59		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.59	(231)
Electricity for lighting		183.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.39	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.48	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.32	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.19	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.87	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	151.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	662.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.73	(265)
Space cooling	(221)	x	0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	56.36	(267)
Electricity for lighting	(232)	x	0.519	=	95.19	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.19	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.89	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	895.73	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	3917.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.38	(265)
Space cooling	(221)	x	3.07	=	105.97	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	333.38	(267)
Electricity for lighting	(232)	x	0	=	563.05	(268)
'Total Primary Energy		sum of (265)…(271) =			5815.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.98	(1a) x	2.7	(2a) =	102.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			38.16	x 0 =	0			(32)
Party wall			14.07	x 0 =	0			(32)
Party floor			37.98					(32a)
Party ceiling			37.98					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8471.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.19	20.07	19.94	19.36	19.25	18.74	18.74	18.64	18.93	19.25	19.47	19.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.03	37.9	37.77	37.19	37.08	36.57	36.57	36.48	36.77	37.08	37.3	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.99	70.33	67.68	65.02	62.37	59.72	59.72	62.37	65.02	67.68	70.33	72.99

Total = Sum(44)$_{1...12}$ = 796.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.24	94.66	97.69	85.16	81.72	70.52	65.34	74.98	75.88	88.43	96.53	104.82

Total = Sum(45)$_{1...12}$ = 1043.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.24	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77	

Output from water heater (annual)$_{1...12}$ 1585.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.75	64.68	69.24	63.89	63.93	59.02	58.49	61.69	60.81	66.16	67.67	71.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	67.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.39	9.22	7.5	5.68	4.25	3.58	3.87	5.03	6.76	8.58	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.49	117.7	114.65	108.17	99.98	92.29	87.15	85.94	88.98	95.47	103.66	111.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	-54.15	(71)

Water heating gains (Table 5)

(72)m=	97.78	96.25	93.07	88.74	85.93	81.98	78.61	82.92	84.45	88.93	93.99	96.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.96	269.48	261.53	248.89	236.46	224.15	215.94	220.2	226.5	239.28	253.96	264.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(75)
Northeast 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(75)
Northeast 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(75)
Northeast 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(75)
Northeast 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(75)

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Northeast 0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(75)
Northeast 0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(75)
Northeast 0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(75)
Northeast 0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(75)
Northeast 0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(75)
Northeast 0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(75)
Northeast 0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.69	336.09	381.54	445.98	501.39	506.59	480.16	430.84	372.73	320.69	295.14	291.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.83	328.38	359.86	370.8	316.44	216.58	144.35	151.17	229.82	287.31	287.58	288.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.88	561.64	510.64	426.23	326.75	217.49	144.45	151.39	236.32	359.74	476.78	575.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.55	(98)
Space heating requirement in kWh/m²/year	24.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
208.36	156.76	112.18	39.91	7.67	0	0	0	0	53.89	136.22	213.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
222.84	167.65	119.98	42.69	8.2	0	0	0	0	57.63	145.69	228.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	154.19	136.17	143.64	129.63	127.67	114.99	111.3	120.93	120.35	134.38	141	150.77

Efficiency of water heater 79.8 (216)

(217)m=	85.62	85.19	84.16	82.08	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.09	159.84	170.67	157.93	158.92	144.09	139.47	151.55	150.81	162.7	166.42	175.85

Total = Sum(219a)$_{1...12}$ = 1918.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.1
Water heating fuel used		1918.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.83 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	214.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.98	(272)

TER = 29.2 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.36	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.16	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	272.02	261.71	267.11	
Total summer gains	677.59	629.57	555.62	**(P5)**
Summer gain/loss ratio	4.4	4.08	3.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.78	21.2	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:32

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.59m²

Site Reference : P1785 St Michaels

Plot Reference: Level 25 Flat 25 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.59 m²	2.7 m

Living area:	30.7 m² (fraction 0.607)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLASED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
S		OPAQUE CURT WALLS	South	0	0
S GLASED DOOR		OPAQUE CURT WALLS	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.17						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.24 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.17	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9612.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.03 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.46	37.24	37.02	35.93	35.71	34.62	34.62	34.4	35.06	35.71	36.15	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Output from water heater (annual)$_{1...12}$ | 1408.29 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	102.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.04	224.34	218.54	206.18	190.57	175.91	166.11	163.81	169.61	181.97	197.58	212.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.38	65.51	62.34	57.89	54.1	58.95	60.68	65.72	71.42	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.99	408.86	393.97	370.92	347.57	326.34	313.68	319.93	332.96	356.19	382.07	401.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(76)
East	0.9x 0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(76)

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East	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(76)
East	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(76)
East	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(76)
East	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(76)
East	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(76)
East	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(76)
East	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(76)
East	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(76)
East	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(76)
East	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.51	200.35	303.33	412.56	486.76	491.72	470.71	415.63	342.02	230.03	133.87	91.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.51	609.22	697.31	783.48	834.33	818.06	784.39	735.56	674.99	586.22	515.93	493.28	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.13	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.14	456.93	453.1	399.28	315.34	211.53	143.29	149.2	229.31	331.54	386.59	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	583.04	567.32	514.92	421.32	321.67	212.6	143.5	149.51	232.36	357.37	475.56	572.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.36 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.42	256.18	261.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.61	254.18	258.76	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	901.08	863.86	805.73	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.94	453.6	406.95	0	0	0	0	

Total = Sum(104) = 1278.49 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.3	96.93	86.96	0	0	0	0

Total = Sum(107) = 273.19 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.99	74.18	46	15.87	4.71	0	0	0	0	19.22	64.06	119.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.23	43.64	27.06	9.34	2.77	0	0	0	0	11.31	37.68	70.2	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.66	124.46	129.77	115.03	111.78	98.52	93.33	104.19	104.57	119.34	127.83	137.81	

Total = Sum(219a)$_{1...12}$ = 1408.29 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.04	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.84 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.21
Water heating fuel used		1408.29
Space cooling fuel used		50.84

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.65	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.65	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.22	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =		35.64	(240)
Space heating - main system 2	(213) x	0	x 0.01 =		0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =		0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x	13.19	x 0.01 =		185.75	(245)
Low-rate cost	(219) x (244) x	13.19	x 0.01 =		0	(246)
Space cooling	(221)	13.19	x 0.01 =		6.71	(248)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =		19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =		30.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				278.07	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)		82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=		140.24	(261)
Space heating (secondary)	(215) x	0.519	=		0	(263)
Water heating	(219) x	0.519	=		730.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				871.14	(265)
Space cooling	(221) x	0.519	=		26.39	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=		75.07	(267)

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Electricity for lighting	(232) x	0.519	=	121.56	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.16	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.63	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.56	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.01	(265)
Space cooling	(221) x	3.07	=	156.09	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.06	(267)
Electricity for lighting	(232) x	0	=	719.06	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.93	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.59	(1a) x	2.7	(2a) =	136.59	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.59	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.59	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.65	9.74	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.17	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9704.8 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.3 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.86	25.73	25.11	25	24.46	24.46	24.36	24.67	25	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.3	47.16	47.03	46.42	46.3	45.76	45.76	45.66	45.97	46.3	46.53	46.78	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.23	79.24	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.24	82.23	

Total = Sum(44)$_{1...12}$ = 897.03 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.94	106.65	110.05	95.95	92.06	79.44	73.62	84.48	85.49	99.63	108.75	118.09	

Total = Sum(45)$_{1...12}$ = 1176.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51	

Output from water heater (annual)$_{1...12}$ | 1722.62 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.72	67.83	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	85.37	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.77	150.31	146.42	138.14	127.68	117.86	111.29	109.75	113.64	121.92	132.38	142.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	-68.3	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.68	99.09	94.22	91.05	86.59	82.81	87.66	89.38	94.43	100.13	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.04	316.38	306.7	291.22	275.77	260.64	250.66	255.45	263.27	278.92	296.9	310.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(76)
East	0.9x 0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(76)

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East	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(76)
East	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(76)
East	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(76)
East	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(76)
East	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(76)
East	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(76)
East	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(76)
East	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(76)
East	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(76)
East	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(76)
South	0.9x	0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.38	180.13	272.99	371.63	438.69	443.24	424.28	374.48	307.93	206.89	120.29	82.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.43	496.51	579.69	662.84	714.46	703.89	674.94	629.93	571.2	485.81	417.19	392.65	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.17	477.86	522.65	503.38	407.94	277.19	186.24	194.94	298.76	405.15	402.62	388.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	735.1	715.44	651.41	541.99	414.51	277.76	186.3	195.05	301.7	460.11	607.48	729.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.4 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.75	159.66	95.8	27.8	4.89	0	0	0	0	40.89	147.5	254.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.55	170.76	102.46	29.73	5.23	0	0	0	0	43.73	157.76	271.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.35	148.57	156.47	140.86	138.48	124.36	120.03	130.89	130.4	146.04	153.66	164.51

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.71	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.27	174.78	187.27	173.08	172.83	155.84	150.41	164.02	163.41	178.27	181.41	191.35

Total = Sum(219a)$_{1...12}$ = 2088.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040	
Water heating fuel used		2088.94	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.17	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.64	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.56	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.34	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.3	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.33	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
South (S)	0	1
South (S GLASED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLASED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLASED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	541.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.34	313.68	319.93	
Total summer gains	909.7	855.13	790.26	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.93	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.53	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:24

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 50.7m²
Site Reference : P1785 St Michaels
Plot Reference: Level 25 Flat 25 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	14.64m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.7 m²	2.7 m

Living area:	30.81 m² (fraction 0.608)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
E	16mm or more	0.8	0.4	1	14.64	1
N	16mm or more	1	0.4	1	1.57	1
N GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
E		OPAQUE CURT WALLS	East	0	0
N		OPAQUE CURT WALLS	North	0	0
N GLASS DOOR		OPAQUE CURT WALLS	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALLS	22.39	18.77	3.62	0.24	0	True	N/A
Internal Elements							
INT WALLS	50.76						N/A
Party Elements							
PARTY WALLS	42.2						N/A
WALLS TO CORRIDOR	22.59						N/A
PARTY CEILING	50.7						N/A
PARTY FLOOR	50.7						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.93	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.35 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			14.64	x 1/[1/(1)+ 0.04]		=	14.08			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	18.77	3.62	x	0.24	=	0.87			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.2	x	0	=	0			(32)
Party wall			22.59	x	0	=	0			(32)
Party floor			50.7							(32a)
Party ceiling			50.7							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

(38)m=	16.47	16.25	16.03	14.94	14.72	13.62	13.62	13.4	14.06	14.72	15.15	15.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.13	36.91	36.69	35.6	35.38	34.29	34.29	34.07	34.73	35.38	35.82	36.26	

Average = Sum(39)$_{1...12}$ /12= 35.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.68	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.7 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Output from water heater (annual)$_{1...12}$ | 1409.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.36	49.74	52.4	47.2	46.42	41.71	40.28	43.89	43.72	48.93	51.46	55.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	102.64	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.22	29.51	24	18.17	13.58	11.46	12.39	16.1	21.61	27.44	32.03	34.14	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.47	224.77	218.96	206.57	190.94	176.25	166.43	164.12	169.94	182.32	197.96	212.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	46.98	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	75.75	74.02	70.43	65.55	62.39	57.93	54.13	58.99	60.72	65.77	71.47	74.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.63	409.49	394.58	371.48	348.09	326.83	314.14	320.41	333.46	356.72	382.65	402.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
East	0.9x	0.77	x	14.64	x	19.64	x	0.4	x	0.8	=	63.76	(76)
East	0.9x	0.77	x	14.64	x	38.42	x	0.4	x	0.8	=	124.73	(76)
East	0.9x	0.77	x	14.64	x	63.27	x	0.4	x	0.8	=	205.42	(76)
East	0.9x	0.77	x	14.64	x	92.28	x	0.4	x	0.8	=	299.59	(76)
East	0.9x	0.77	x	14.64	x	113.09	x	0.4	x	0.8	=	367.16	(76)
East	0.9x	0.77	x	14.64	x	115.77	x	0.4	x	0.8	=	375.86	(76)
East	0.9x	0.77	x	14.64	x	110.22	x	0.4	x	0.8	=	357.83	(76)
East	0.9x	0.77	x	14.64	x	94.68	x	0.4	x	0.8	=	307.37	(76)
East	0.9x	0.77	x	14.64	x	73.59	x	0.4	x	0.8	=	238.91	(76)
East	0.9x	0.77	x	14.64	x	45.59	x	0.4	x	0.8	=	148.01	(76)
East	0.9x	0.77	x	14.64	x	24.49	x	0.4	x	0.8	=	79.51	(76)
East	0.9x	0.77	x	14.64	x	16.15	x	0.4	x	0.8	=	52.44	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	73.67	143.67	237.6	351.28	436.79	450.4	427.43	362.59	277.6	170.55	91.73	60.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.3	553.17	632.18	722.77	784.89	777.22	741.57	682.99	611.06	527.28	474.38	462.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.56	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.39	20.65	20.88	20.97	20.99	21	21	20.98	20.85	20.51	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.34	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.88	20.19	20.31	20.36	20.36	20.36	20.34	20.16	19.71	19.2	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.8	20.05	20.35	20.61	20.71	20.74	20.75	20.75	20.73	20.58	20.2	19.78	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.4	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.33	433.74	435.52	391.03	311.55	209.49	142	147.8	226.25	321.18	369.65	394.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	575.52	559.19	508.26	416.88	318.68	210.66	142.24	148.18	230.14	353.05	469.13	564.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 508.8 (98)

Space heating requirement in kWh/m²/year 10.04 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	322.3	253.73	258.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	316.98	251.48	255.7	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	853.27	813.73	744.21	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	386.12	418.31	363.45	0	0	0	0	

Total = Sum(104) = 1167.89 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	82.54	89.42	77.69	0	0	0	0

Total = Sum(107) = 249.64 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.92 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	124.39	84.3	54.12	18.62	5.31	0	0	0	0	23.71	71.63	126.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	73.17	49.59	31.83	10.95	3.12	0	0	0	0	13.95	42.13	74.55	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 299.3 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.78	124.57	129.88	115.13	111.88	98.61	93.41	104.28	104.65	119.44	127.94	137.93	

Total = Sum(219a)$_{1...12}$ = 1409.5 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.36	16.64	14.46	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 46.46 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		299.3
Water heating fuel used		1409.5
Space cooling fuel used		46.46

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.96	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.96	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2134.89	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	39.48	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.91	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.13	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.95	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					281.59	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	155.33	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	731.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =					886.87	(265)
Space cooling	(221)	x		0.519	=	24.11	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.23	(267)

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Electricity for lighting	(232) x	0.519	=	121.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1108.01	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.85	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	918.84	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	4327.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5246.01	(265)
Space cooling	(221)	x	3.07	=	142.64	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	445.03	(267)
Electricity for lighting	(232)	x	0	=	720.44	(268)
'Total Primary Energy	sum of (265)…(271) =				6554.13	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.27	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.7	(1a) x	2.7	(2a) =	136.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.7	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.89	x1/[1/(1.5)+ 0.04] =	14			(27)
Windows Type 2			1.06	x1/[1/(1.5)+ 0.04] =	1.5			(27)
Windows Type 3			1.73	x1/[1/(1.5)+ 0.04] =	2.45			(27)
Walls	22.39	12.68	9.71	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.2	x 0 =	0			(32)
Party wall			22.59	x 0 =	0			(32)
Party floor			50.7					(32a)
Party ceiling			50.7					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9582.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26.05	25.91	25.78	25.16	25.05	24.51	24.51	24.41	24.72	25.05	25.28	25.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.39	47.25	47.12	46.5	46.39	45.85	45.85	45.75	46.06	46.39	46.62	46.87	

Average = Sum(39)$_{1...12}$ /12= 46.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.83 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.31	79.32	76.33	73.33	70.34	67.35	67.35	70.34	73.33	76.33	79.32	82.31	

Total = Sum(44)$_{1...12}$ = 897.96 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	

Total = Sum(45)$_{1...12}$ = 1177.36 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.31	16.01	16.53	14.41	13.82	11.93	11.05	12.68	12.84	14.96	16.33	17.73	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63	

Output from water heater (annual)$_{1...12}$ | 1723.83 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	69.03	73.76	67.87	67.77	62.37	61.63	65.25	64.39	70.29	72.13	76.44	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	85.54	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.29	11.8	9.6	7.27	5.43	4.59	4.96	6.44	8.64	10.98	12.81	13.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.05	150.6	146.7	138.4	127.93	118.08	111.51	109.96	113.86	122.16	132.63	142.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	31.55	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	-68.43	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.73	99.14	94.26	91.09	86.63	82.84	87.7	89.42	94.48	100.18	102.74	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.46	316.79	307.1	291.59	276.11	260.96	250.96	255.76	263.59	279.27	297.28	310.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.06	x	10.63	x	0.63	x	0.7	=	3.44	(74)
North	0.9x 0.77	x	1.73	x	10.63	x	0.63	x	0.7	=	5.62	(74)

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North	0.9x	0.77	x	1.06	x	20.32	x	0.63	x	0.7	=	6.58	(74)
North	0.9x	0.77	x	1.73	x	20.32	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	1.06	x	34.53	x	0.63	x	0.7	=	11.19	(74)
North	0.9x	0.77	x	1.73	x	34.53	x	0.63	x	0.7	=	18.26	(74)
North	0.9x	0.77	x	1.06	x	55.46	x	0.63	x	0.7	=	17.97	(74)
North	0.9x	0.77	x	1.73	x	55.46	x	0.63	x	0.7	=	29.32	(74)
North	0.9x	0.77	x	1.06	x	74.72	x	0.63	x	0.7	=	24.2	(74)
North	0.9x	0.77	x	1.73	x	74.72	x	0.63	x	0.7	=	39.5	(74)
North	0.9x	0.77	x	1.06	x	79.99	x	0.63	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	1.73	x	79.99	x	0.63	x	0.7	=	42.29	(74)
North	0.9x	0.77	x	1.06	x	74.68	x	0.63	x	0.7	=	24.19	(74)
North	0.9x	0.77	x	1.73	x	74.68	x	0.63	x	0.7	=	39.48	(74)
North	0.9x	0.77	x	1.06	x	59.25	x	0.63	x	0.7	=	19.19	(74)
North	0.9x	0.77	x	1.73	x	59.25	x	0.63	x	0.7	=	31.32	(74)
North	0.9x	0.77	x	1.06	x	41.52	x	0.63	x	0.7	=	13.45	(74)
North	0.9x	0.77	x	1.73	x	41.52	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	1.06	x	24.19	x	0.63	x	0.7	=	7.84	(74)
North	0.9x	0.77	x	1.73	x	24.19	x	0.63	x	0.7	=	12.79	(74)
North	0.9x	0.77	x	1.06	x	13.12	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.73	x	13.12	x	0.63	x	0.7	=	6.94	(74)
North	0.9x	0.77	x	1.06	x	8.86	x	0.63	x	0.7	=	2.87	(74)
North	0.9x	0.77	x	1.73	x	8.86	x	0.63	x	0.7	=	4.69	(74)
East	0.9x	0.77	x	9.89	x	19.64	x	0.63	x	0.7	=	59.36	(76)
East	0.9x	0.77	x	9.89	x	38.42	x	0.63	x	0.7	=	116.13	(76)
East	0.9x	0.77	x	9.89	x	63.27	x	0.63	x	0.7	=	191.24	(76)
East	0.9x	0.77	x	9.89	x	92.28	x	0.63	x	0.7	=	278.92	(76)
East	0.9x	0.77	x	9.89	x	113.09	x	0.63	x	0.7	=	341.82	(76)
East	0.9x	0.77	x	9.89	x	115.77	x	0.63	x	0.7	=	349.92	(76)
East	0.9x	0.77	x	9.89	x	110.22	x	0.63	x	0.7	=	333.14	(76)
East	0.9x	0.77	x	9.89	x	94.68	x	0.63	x	0.7	=	286.16	(76)
East	0.9x	0.77	x	9.89	x	73.59	x	0.63	x	0.7	=	222.42	(76)
East	0.9x	0.77	x	9.89	x	45.59	x	0.63	x	0.7	=	137.79	(76)
East	0.9x	0.77	x	9.89	x	24.49	x	0.63	x	0.7	=	74.02	(76)
East	0.9x	0.77	x	9.89	x	16.15	x	0.63	x	0.7	=	48.82	(76)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.43	133.45	220.69	326.21	405.53	418.12	396.81	336.68	257.82	158.42	85.2	56.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.89	450.25	527.79	617.8	681.65	679.08	647.77	592.44	521.41	437.69	382.49	366.91	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.99	0.98	0.94	0.82	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.38	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.27	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.78	439.08	490.33	491.87	406.86	277.61	186.62	195.3	297.47	384.17	373.31	363.93	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	733.45	712.49	649.08	541.8	415.15	278.31	186.68	195.45	302.13	458.77	605.42	728.49	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1098.71 (98)

Space heating requirement in kWh/m²/year 21.67 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	260.9	183.73	118.11	35.95	6.17	0	0	0	0	55.5	167.12	271.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	279.03	196.5	126.32	38.45	6.6	0	0	0	0	59.36	178.74	290.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1175.09 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.48	148.68	156.58	140.96	138.57	124.44	120.11	130.98	130.49	146.14	153.78	164.63

Efficiency of water heater 79.8 (216)

(217)m=	85.98	85.38	84.07	81.76	80.2	79.8	79.8	79.8	79.8	82.48	85.04	86.14

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.96	174.14	186.24	172.4	172.77	155.94	150.51	164.13	163.52	177.17	180.84	191.12

Total = Sum(219a)$_{1...12}$ = 2084.75 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1175.09	
Water heating fuel used		2084.75	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.67	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3569.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	253.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				704.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			864.85	(272)

TER = 24.7 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.69	**(P1)**
Transmission heat loss coefficient:	20.7	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (E)	0	1
North (N)	0	1
North (N GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
East (E)	0.9 x	14.64	108.47	0.4	0.8	0.9	411.61	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLASS DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	491.66	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.83	314.14	320.41	
Total summer gains	861.16	805.8	730.71	**(P5)**
Summer gain/loss ratio	4.28	4	3.63	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.28	21.7	21.23	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:16

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels
Plot Reference: Level 25 Flat 25 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	26.59 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.88 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	31.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 25 Flat 25 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.493)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.11	16.53	4.58	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.63						N/A
WALLS TO CORRIDOR	15.75						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1035

	Length	**Psi-value**		
[Approved]	15.33	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

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	38.8	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.44 (fraction 0.855)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.11	16.53	4.58	x	0.24	=	1.1			(29)
Total area of elements, m²			21.11							(31)
Party wall			36.63	x	0	=	0			(32)
Party wall			15.75	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.99 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.51	31.34	31.18	30.36	30.2	29.38	29.38	29.21	29.71	30.2	30.53	30.85	

Average = Sum(39)$_{1...12}$ /12= 30.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	16.53	x	36.79	x	0.4	x	0.8	=	134.87	(77)
Southeast 0.9x	0.77	x	16.53	x	62.67	x	0.4	x	0.8	=	229.74	(77)
Southeast 0.9x	0.77	x	16.53	x	85.75	x	0.4	x	0.8	=	314.34	(77)
Southeast 0.9x	0.77	x	16.53	x	106.25	x	0.4	x	0.8	=	389.49	(77)
Southeast 0.9x	0.77	x	16.53	x	119.01	x	0.4	x	0.8	=	436.26	(77)

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Southeast	0.9x	0.77	x	16.53	x	118.15	x	0.4	x	0.8	=	433.1		(77)
Southeast	0.9x	0.77	x	16.53	x	113.91	x	0.4	x	0.8	=	417.56		(77)
Southeast	0.9x	0.77	x	16.53	x	104.39	x	0.4	x	0.8	=	382.66		(77)
Southeast	0.9x	0.77	x	16.53	x	92.85	x	0.4	x	0.8	=	340.37		(77)
Southeast	0.9x	0.77	x	16.53	x	69.27	x	0.4	x	0.8	=	253.91		(77)
Southeast	0.9x	0.77	x	16.53	x	44.07	x	0.4	x	0.8	=	161.55		(77)
Southeast	0.9x	0.77	x	16.53	x	31.49	x	0.4	x	0.8	=	115.42		(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	134.87	229.74	314.34	389.49	436.26	433.1	417.56	382.66	340.37	253.91	161.55	115.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	475.72	567.95	640.52	697.11	725.28	705.04	679.18	649.7	617.78	550.03	478.52	447.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.8	0.72	0.62	0.5	0.38	0.26	0.19	0.21	0.33	0.53	0.72	0.82	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.48	20.71	20.88	20.96	20.99	21	21	20.98	20.88	20.57	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.78	0.7	0.6	0.47	0.35	0.24	0.16	0.17	0.29	0.5	0.7	0.8	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.57	19.87	20.11	20.21	20.27	20.27	20.28	20.25	20.12	19.72	19.19	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.72	20.02	20.28	20.49	20.58	20.62	20.63	20.63	20.61	20.49	20.14	19.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.77	0.69	0.6	0.48	0.36	0.25	0.17	0.19	0.31	0.51	0.69	0.79	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	367.1	392.57	382.52	332.88	261.96	175.78	118.17	123.3	190.75	279.45	331.42	353.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	485.91	474	429.75	351.96	268.21	177	118.43	123.65	193.43	298.72	397.98	477.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	350.96	(98)
Space heating requirement in kWh/m²/year	9.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	276.16	217.4	222.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	270.8	215.07	219.15	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	778.16	749.68	714.3	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	365.3	397.75	368.39	0	0	0	0	
Total = Sum(104) =													1131.43 (104)
Cooled fraction f C = cooled area ÷ (4) =													0.85 (105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104) =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	78.04	84.98	78.7	0	0	0	0	
Total = Sum(107) =													241.73 (107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =													6.37 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	88.39	54.72	35.14	13.74	4.65	0	0	0	0	14.34	47.92	92.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	52	32.19	20.67	8.08	2.74	0	0	0	0	8.43	28.19	54.15	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													206.45 (211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	14.53	15.82	14.65	0	0	0	0

Total = Sum(221)$_{6...8}$ = 44.99 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		206.45	
Water heating fuel used		1275.92	
Space cooling fuel used		44.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1819.21	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	27.23		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	168.29		(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	5.93		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	24.18		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				239.95		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.05	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	107.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				769.35	(265)
Space cooling	(221) x		0.519	=	23.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			944.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			24.87	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	633.79	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4550.85	(265)
Space cooling	(221) x		3.07	=	138.12	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5584.98	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			147.13	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.11	9.49	11.62	x 0.18 =	2.09			(29)
Total area of elements, m²			21.11					(31)
Party wall			36.63	x 0 =	0			(32)
Party wall			15.75	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7260.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.89	37.76	37.64	37.05	36.94	36.43	36.43	36.34	36.63	36.94	37.16	37.4	

Average = Sum(39)$_{1...12}$ /12= 37.05 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	9.49	x	36.79	x	0.63	x	0.7	=	106.71	(77)
Southeast 0.9x	0.77	x	9.49	x	62.67	x	0.63	x	0.7	=	181.77	(77)
Southeast 0.9x	0.77	x	9.49	x	85.75	x	0.63	x	0.7	=	248.71	(77)
Southeast 0.9x	0.77	x	9.49	x	106.25	x	0.63	x	0.7	=	308.16	(77)
Southeast 0.9x	0.77	x	9.49	x	119.01	x	0.63	x	0.7	=	345.16	(77)

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Southeast 0.9x	0.77	x	9.49	x	118.15	x	0.63	x	0.7	=	342.67	(77)
Southeast 0.9x	0.77	x	9.49	x	113.91	x	0.63	x	0.7	=	330.37	(77)
Southeast 0.9x	0.77	x	9.49	x	104.39	x	0.63	x	0.7	=	302.76	(77)
Southeast 0.9x	0.77	x	9.49	x	92.85	x	0.63	x	0.7	=	269.3	(77)
Southeast 0.9x	0.77	x	9.49	x	69.27	x	0.63	x	0.7	=	200.89	(77)
Southeast 0.9x	0.77	x	9.49	x	44.07	x	0.63	x	0.7	=	127.82	(77)
Southeast 0.9x	0.77	x	9.49	x	31.49	x	0.63	x	0.7	=	91.32	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.71	181.77	248.71	308.16	345.16	342.67	330.37	302.76	269.3	200.89	127.82	91.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	377.6	451.18	510.16	556.99	581.57	566.77	546.26	522.91	495.74	440.12	381.71	355.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.88	0.75	0.58	0.41	0.29	0.32	0.5	0.79	0.95	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.33	20.54	20.75	20.92	20.98	21	21	21	20.99	20.9	20.6	20.29	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.85	0.7	0.53	0.35	0.23	0.26	0.44	0.74	0.93	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.52	19.8	20.02	20.09	20.12	20.12	20.12	20.11	20.01	19.62	19.17	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.77	20.02	20.27	20.46	20.53	20.55	20.55	20.55	20.54	20.45	20.11	19.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.86	0.72	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	365.7	419.57	437.03	401.98	320.97	216.31	143.94	150.84	234.38	334.81	355.64	347.05	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	586.06	570.93	518.24	428.37	326.21	216.8	143.99	150.92	236.07	363.99	483.39	580.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	636.4	(98)
Space heating requirement in kWh/m²/year	16.76	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
163.95	101.71	60.42	19	3.9	0	0	0	0	21.71	91.98	173.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
175.35	108.78	64.62	20.32	4.17	0	0	0	0	23.22	98.38	185.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 680.64 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

(217)m=	84.98	84.05	82.7	81.02	80.08	79.8	79.8	79.8	79.8	81.13	83.71	85.19

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.42	161.99	173.67	159.97	159.41	144.08	139.45	151.53	150.79	165.61	168.42	176.96

Total = Sum(219a)$_{1...12}$ = 1933.31 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		680.64
Water heating fuel used		1933.31
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2872.28 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	147.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	417.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			564.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			698.68	(272)

TER = 26.59 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.47	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	16.53	112.1	0.4	0.8	0.9	480.31	
						Total	480.31	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	785.75	741.93	700.06	**(P5)**
Summer gain/loss ratio	5.09	4.8	4.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.09	22.5	22.13	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:08

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 86.48m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 25 Flat 25 07

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.93 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.82 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	33.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.0 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	19.16m²
Windows facing: South East	11.33m²
Windows facing: South East	2.56m²
Windows facing: South East	6.79m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	86.48 m²	2.7 m
Living area:	42.37 m² (fraction 0.49)	
Front of dwelling faces:	North	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE		Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	19.16	1
S	16mm or more	1	0.4	1	11.33	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	1	0.4	1	6.79	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
S		OPAQUE CURT WALL	South East	0	0
S GLASS DOOR		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.47	39.84	7.63	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	59.08						N/A
WALLS TO CORRIDOR	21.3						N/A
PARTY CEILING	86.48						N/A

SAP Input

PARTY FLOOR	86.48	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0774

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	29.94	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.49 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.16	x 1/[1/(1)+ 0.04]		=	18.42			(27)
Windows Type 2			11.33	x 1/[1/(1)+ 0.04]		=	10.89			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 4			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Walls	47.47	39.84	7.63	x	0.24	=	1.83			(29)
Total area of elements, m²			47.47							(31)
Party wall			59.08	x	0	=	0			(32)
Party wall			21.3	x	0	=	0			(32)
Party floor			86.48							(32a)
Party ceiling			86.48							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.81 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.93	29.52	29.11	27.07	26.66	24.61	24.61	24.2	25.43	26.66	27.47	28.29	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.74	73.33	72.92	70.88	70.47	68.42	68.42	68.01	69.24	70.47	71.29	72.11	

Average = Sum(39)$_{1...12}$ /12= 70.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.84	0.82	0.81	0.79	0.79	0.79	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.82 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57	

Output from water heater (annual)$_{1...12}$ — 1852.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.67	66.87	70.63	63.87	63	56.88	55.18	59.78	59.44	66.21	69.3	74.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	154.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.81	46.02	37.42	28.33	21.18	17.88	19.32	25.11	33.7	42.8	49.95	53.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.94	350.54	341.47	322.16	297.78	274.86	259.55	255.95	265.03	284.34	308.72	331.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	53.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	101.71	99.5	94.93	88.71	84.68	78.99	74.16	80.35	82.55	88.99	96.25	99.51	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.97	600.57	578.33	543.71	508.14	476.24	457.54	465.93	485.79	520.63	559.43	588.9	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	19.16	x	36.79	x	0.4	x	0.8	=	156.33	(77)
Southeast	0.9x	0.77	x	11.33	x	36.79	x	0.4	x	1	=	115.56	(77)
Southeast	0.9x	0.77	x	2.56	x	36.79	x	0.4	x	0.7	=	18.28	(77)
Southeast	0.9x	0.77	x	6.79	x	36.79	x	0.4	x	1	=	69.25	(77)
Southeast	0.9x	0.77	x	19.16	x	62.67	x	0.4	x	0.8	=	266.29	(77)
Southeast	0.9x	0.77	x	11.33	x	62.67	x	0.4	x	1	=	196.84	(77)
Southeast	0.9x	0.77	x	2.56	x	62.67	x	0.4	x	0.7	=	31.13	(77)
Southeast	0.9x	0.77	x	6.79	x	62.67	x	0.4	x	1	=	117.96	(77)
Southeast	0.9x	0.77	x	19.16	x	85.75	x	0.4	x	0.8	=	364.36	(77)
Southeast	0.9x	0.77	x	11.33	x	85.75	x	0.4	x	1	=	269.32	(77)
Southeast	0.9x	0.77	x	2.56	x	85.75	x	0.4	x	0.7	=	42.6	(77)
Southeast	0.9x	0.77	x	6.79	x	85.75	x	0.4	x	1	=	161.4	(77)
Southeast	0.9x	0.77	x	19.16	x	106.25	x	0.4	x	0.8	=	451.45	(77)
Southeast	0.9x	0.77	x	11.33	x	106.25	x	0.4	x	1	=	333.7	(77)
Southeast	0.9x	0.77	x	2.56	x	106.25	x	0.4	x	0.7	=	52.78	(77)
Southeast	0.9x	0.77	x	6.79	x	106.25	x	0.4	x	1	=	199.99	(77)
Southeast	0.9x	0.77	x	19.16	x	119.01	x	0.4	x	0.8	=	505.67	(77)
Southeast	0.9x	0.77	x	11.33	x	119.01	x	0.4	x	1	=	373.77	(77)
Southeast	0.9x	0.77	x	2.56	x	119.01	x	0.4	x	0.7	=	59.12	(77)
Southeast	0.9x	0.77	x	6.79	x	119.01	x	0.4	x	1	=	224	(77)
Southeast	0.9x	0.77	x	19.16	x	118.15	x	0.4	x	0.8	=	502.01	(77)
Southeast	0.9x	0.77	x	11.33	x	118.15	x	0.4	x	1	=	371.07	(77)
Southeast	0.9x	0.77	x	2.56	x	118.15	x	0.4	x	0.7	=	58.69	(77)
Southeast	0.9x	0.77	x	6.79	x	118.15	x	0.4	x	1	=	222.38	(77)
Southeast	0.9x	0.77	x	19.16	x	113.91	x	0.4	x	0.8	=	483.99	(77)
Southeast	0.9x	0.77	x	11.33	x	113.91	x	0.4	x	1	=	357.75	(77)
Southeast	0.9x	0.77	x	2.56	x	113.91	x	0.4	x	0.7	=	56.58	(77)
Southeast	0.9x	0.77	x	6.79	x	113.91	x	0.4	x	1	=	214.4	(77)
Southeast	0.9x	0.77	x	19.16	x	104.39	x	0.4	x	0.8	=	443.55	(77)
Southeast	0.9x	0.77	x	11.33	x	104.39	x	0.4	x	1	=	327.86	(77)
Southeast	0.9x	0.77	x	2.56	x	104.39	x	0.4	x	0.7	=	51.86	(77)
Southeast	0.9x	0.77	x	6.79	x	104.39	x	0.4	x	1	=	196.48	(77)
Southeast	0.9x	0.77	x	19.16	x	92.85	x	0.4	x	0.8	=	394.52	(77)
Southeast	0.9x	0.77	x	11.33	x	92.85	x	0.4	x	1	=	291.62	(77)
Southeast	0.9x	0.77	x	2.56	x	92.85	x	0.4	x	0.7	=	46.12	(77)
Southeast	0.9x	0.77	x	6.79	x	92.85	x	0.4	x	1	=	174.76	(77)
Southeast	0.9x	0.77	x	19.16	x	69.27	x	0.4	x	0.8	=	294.31	(77)
Southeast	0.9x	0.77	x	11.33	x	69.27	x	0.4	x	1	=	217.55	(77)
Southeast	0.9x	0.77	x	2.56	x	69.27	x	0.4	x	0.7	=	34.41	(77)
Southeast	0.9x	0.77	x	6.79	x	69.27	x	0.4	x	1	=	130.37	(77)
Southeast	0.9x	0.77	x	19.16	x	44.07	x	0.4	x	0.8	=	187.25	(77)

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Southeast 0.9x	0.77	x	11.33	x	44.07	x	0.4	x	1	=	138.41	(77)
Southeast 0.9x	0.77	x	2.56	x	44.07	x	0.4	x	0.7	=	21.89	(77)
Southeast 0.9x	0.77	x	6.79	x	44.07	x	0.4	x	1	=	82.95	(77)
Southeast 0.9x	0.77	x	19.16	x	31.49	x	0.4	x	0.8	=	133.79	(77)
Southeast 0.9x	0.77	x	11.33	x	31.49	x	0.4	x	1	=	98.89	(77)
Southeast 0.9x	0.77	x	2.56	x	31.49	x	0.4	x	0.7	=	15.64	(77)
Southeast 0.9x	0.77	x	6.79	x	31.49	x	0.4	x	1	=	59.27	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	359.42	612.23	837.68	1037.92	1162.56	1154.15	1112.73	1019.74	907.03	676.64	430.5	307.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.39	1212.8	1416.01	1581.63	1670.7	1630.39	1570.27	1485.67	1392.82	1197.27	989.94	896.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.56	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.38	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.46	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.22	20.24	20.24	20.26	20.26	20.27	20.25	20.24	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.35	0.24	0.16	0.18	0.3	0.53	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.95	19.41	19.79	20.08	20.19	20.25	20.26	20.26	20.23	20.07	19.55	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.88	20.21	20.46	20.57	20.61	20.62	20.62	20.6	20.45	19.99	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.81	0.72	0.62	0.49	0.36	0.25	0.17	0.19	0.32	0.53	0.74	0.83	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	784.66	875.9	874.13	770.31	608.94	408.39	274.45	286.24	442.66	639.84	727.96	747.53	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.52	1098.9	1000.06	819.65	624.82	411.5	275.13	287.18	449.92	694.11	919.05	1097.73	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 978.53 (98)

Space heating requirement in kWh/m²/year 11.32 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	643.16	506.32	516.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	630.24	500.66	509.71	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1825.25	1758.13	1657.83	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.41	935.56	854.2	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 2650.17 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	182.79	198.76	181.47	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 563.02 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.51 (108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	249.14	149.85	93.69	35.52	11.82	0	0	0	0	40.38	137.58	260.55	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	146.55	88.15	55.11	20.9	6.95	0	0	0	0	23.75	80.93	153.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 575.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

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Water heating

Output from water heater (calculated above)

	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.47	163.07	170.31	151.36	147.37	130.31	123.84	137.69	138.01	157.01	167.68	180.57

Total = Sum(219a)$_{1...12}$ = 1852.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	34.02	36.99	33.77	0	0	0	0

Total = Sum(221)$_{6...8}$ = 104.79 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		575.61	
Water heating fuel used		1852.69	
Space cooling fuel used		104.79	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.26		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.26	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3146.33	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	75.92	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	244.37	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	13.82	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	32.61	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	48.27	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		415	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.51	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	298.74	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	961.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1260.29	(265)
Space cooling	(221) x		0.519	=	54.38	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	128.33	(267)
Electricity for lighting	(232) x		0.519	=	189.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1632.94	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.88	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1767.11	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5687.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7454.88	(265)
Space cooling	(221) x		3.07	=	321.7	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	759.1	(267)
Electricity for lighting	(232) x		0	=	1123.55	(268)
'Total Primary Energy		sum of (265)…(271) =			9659.23	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.69	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.48	(1a) x	2.7	(2a) =	233.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.48	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.5	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.4	x1/[1/(1.5)+ 0.04] =	14.72			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Windows Type 4			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Walls	47.47	21.62	25.85	x 0.18 =	4.65			(29)
Total area of elements, m²			47.47					(31)
Party wall			59.08	x 0 =	0			(32)
Party wall			21.3	x 0 =	0			(32)
Party floor			86.48					(32a)
Party ceiling			86.48					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16674.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.82 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.01	44.76	44.51	43.35	43.13	42.13	42.13	41.94	42.51	43.13	43.57	44.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	83.83	83.57	83.33	82.17	81.95	80.94	80.94	80.76	81.33	81.95	82.39	82.85	

Average = Sum(39)$_{1...12}$ /12= 82.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.88	101.06	97.25	93.44	89.62	85.81	85.81	89.62	93.44	97.25	101.06	104.88	

Total = Sum(44)$_{1...12}$ = 1144.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.53	136.03	140.37	122.38	117.42	101.33	93.89	107.74	109.03	127.07	138.7	150.62	

Total = Sum(45)$_{1...12}$ = 1500.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.33	20.4	21.06	18.36	17.61	15.2	14.08	16.16	16.35	19.06	20.81	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	

Output from water heater (annual)$_{1...12}$ — 2089.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.79	81.42	86.75	79.47	79.12	72.47	71.29	75.9	75.03	82.32	84.9	90.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	128.72	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.72	18.41	14.97	11.33	8.47	7.15	7.73	10.04	13.48	17.12	19.98	21.3	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.45	234.86	228.78	215.84	199.51	184.16	173.9	171.49	177.57	190.51	206.84	222.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	-102.98	(71)

Water heating gains (Table 5)

(72)m=	123.37	121.17	116.59	110.38	106.34	100.66	95.82	102.01	104.21	110.65	117.92	121.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	441.16	439.05	424.96	402.17	378.94	356.58	342.07	348.16	359.88	382.89	409.35	429.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southeast	0.9x	0.77	x	10.4	x	36.79	x	0.63	x	0.7	=	116.94	(77)
Southeast	0.9x	0.77	x	6.15	x	36.79	x	0.63	x	0.7	=	69.15	(77)
Southeast	0.9x	0.77	x	1.39	x	36.79	x	0.63	x	0.7	=	15.63	(77)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.63	x	0.7	=	41.38	(77)
Southeast	0.9x	0.77	x	10.4	x	62.67	x	0.63	x	0.7	=	199.2	(77)
Southeast	0.9x	0.77	x	6.15	x	62.67	x	0.63	x	0.7	=	117.8	(77)
Southeast	0.9x	0.77	x	1.39	x	62.67	x	0.63	x	0.7	=	26.62	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.63	x	0.7	=	70.49	(77)
Southeast	0.9x	0.77	x	10.4	x	85.75	x	0.63	x	0.7	=	272.55	(77)
Southeast	0.9x	0.77	x	6.15	x	85.75	x	0.63	x	0.7	=	161.17	(77)
Southeast	0.9x	0.77	x	1.39	x	85.75	x	0.63	x	0.7	=	36.43	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.63	x	0.7	=	96.44	(77)
Southeast	0.9x	0.77	x	10.4	x	106.25	x	0.63	x	0.7	=	337.71	(77)
Southeast	0.9x	0.77	x	6.15	x	106.25	x	0.63	x	0.7	=	199.7	(77)
Southeast	0.9x	0.77	x	1.39	x	106.25	x	0.63	x	0.7	=	45.14	(77)
Southeast	0.9x	0.77	x	3.68	x	106.25	x	0.63	x	0.7	=	119.5	(77)
Southeast	0.9x	0.77	x	10.4	x	119.01	x	0.63	x	0.7	=	378.26	(77)
Southeast	0.9x	0.77	x	6.15	x	119.01	x	0.63	x	0.7	=	223.68	(77)
Southeast	0.9x	0.77	x	1.39	x	119.01	x	0.63	x	0.7	=	50.56	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.63	x	0.7	=	133.85	(77)
Southeast	0.9x	0.77	x	10.4	x	118.15	x	0.63	x	0.7	=	375.53	(77)
Southeast	0.9x	0.77	x	6.15	x	118.15	x	0.63	x	0.7	=	222.07	(77)
Southeast	0.9x	0.77	x	1.39	x	118.15	x	0.63	x	0.7	=	50.19	(77)
Southeast	0.9x	0.77	x	3.68	x	118.15	x	0.63	x	0.7	=	132.88	(77)
Southeast	0.9x	0.77	x	10.4	x	113.91	x	0.63	x	0.7	=	362.05	(77)
Southeast	0.9x	0.77	x	6.15	x	113.91	x	0.63	x	0.7	=	214.09	(77)
Southeast	0.9x	0.77	x	1.39	x	113.91	x	0.63	x	0.7	=	48.39	(77)
Southeast	0.9x	0.77	x	3.68	x	113.91	x	0.63	x	0.7	=	128.11	(77)
Southeast	0.9x	0.77	x	10.4	x	104.39	x	0.63	x	0.7	=	331.79	(77)
Southeast	0.9x	0.77	x	6.15	x	104.39	x	0.63	x	0.7	=	196.2	(77)
Southeast	0.9x	0.77	x	1.39	x	104.39	x	0.63	x	0.7	=	44.35	(77)
Southeast	0.9x	0.77	x	3.68	x	104.39	x	0.63	x	0.7	=	117.4	(77)
Southeast	0.9x	0.77	x	10.4	x	92.85	x	0.63	x	0.7	=	295.12	(77)
Southeast	0.9x	0.77	x	6.15	x	92.85	x	0.63	x	0.7	=	174.52	(77)
Southeast	0.9x	0.77	x	1.39	x	92.85	x	0.63	x	0.7	=	39.44	(77)
Southeast	0.9x	0.77	x	3.68	x	92.85	x	0.63	x	0.7	=	104.43	(77)
Southeast	0.9x	0.77	x	10.4	x	69.27	x	0.63	x	0.7	=	220.16	(77)
Southeast	0.9x	0.77	x	6.15	x	69.27	x	0.63	x	0.7	=	130.19	(77)
Southeast	0.9x	0.77	x	1.39	x	69.27	x	0.63	x	0.7	=	29.43	(77)
Southeast	0.9x	0.77	x	3.68	x	69.27	x	0.63	x	0.7	=	77.9	(77)
Southeast	0.9x	0.77	x	10.4	x	44.07	x	0.63	x	0.7	=	140.07	(77)

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Southeast	0.9x	0.77	x	6.15	x	44.07	x	0.63	x	0.7	=	82.83	(77)
Southeast	0.9x	0.77	x	1.39	x	44.07	x	0.63	x	0.7	=	18.72	(77)
Southeast	0.9x	0.77	x	3.68	x	44.07	x	0.63	x	0.7	=	49.56	(77)
Southeast	0.9x	0.77	x	10.4	x	31.49	x	0.63	x	0.7	=	100.08	(77)
Southeast	0.9x	0.77	x	6.15	x	31.49	x	0.63	x	0.7	=	59.18	(77)
Southeast	0.9x	0.77	x	1.39	x	31.49	x	0.63	x	0.7	=	13.38	(77)
Southeast	0.9x	0.77	x	3.68	x	31.49	x	0.63	x	0.7	=	35.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	243.11	414.11	566.6	702.04	786.35	780.66	752.64	689.74	613.51	457.68	291.19	208.05	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	684.27	853.16	991.56	1104.21	1165.28	1137.24	1094.71	1037.91	973.38	840.57	700.54	637.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.63	0.45	0.33	0.36	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.48	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.77	0.58	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.37	19.72	20	20.11	20.14	20.14	20.14	20.13	19.98	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.43	20.53	20.56	20.56	20.56	20.55	20.41	19.97	19.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.61	0.42	0.29	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.69	821.37	897.97	863.51	706.44	480.52	320.35	335.7	518.22	701.82	678.27	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1282.94	1252.51	1140.46	947.7	723.71	482.21	320.5	335.97	524.52	803.74	1060.14	1272.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1822.73	(98)
Space heating requirement in kWh/m²/year	21.08	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
451.79	289.73	180.41	60.62	12.85	0	0	0	0	75.83	274.94	476.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
483.2	309.87	192.96	64.83	13.74	0	0	0	0	81.1	294.06	509.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1949.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	205.62	181.27	190.46	170.85	167.51	149.8	143.99	157.84	157.51	177.16	187.18	200.71	
Efficiency of water heater												79.8	(216)
(217)m=	86.86	86.06	84.67	82.35	80.48	79.8	79.8	79.8	79.8	82.73	85.84	87.04	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	236.73	210.64	224.94	207.47	208.15	187.72	180.43	197.79	197.38	214.13	218.06	230.6	
Total = Sum(219a)$_{1...12}$ =												2514.04	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1949.44	
Water heating fuel used		2514.04	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.98	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4904.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	421.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			964.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.94	(268)
Total CO2, kg/year	sum of (265)…(271) =			1192.98	(272)

TER = 19.93 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	308.21	**(P1)**
Transmission heat loss coefficient:	43.8	
Summer heat loss coefficient:	352.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
South East (S)	0	1
South East (S GLASS DOOR)	0	1
South East (E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
South East (S)	1	0.9	1	0.9	**(P8)**
South East (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**
South East (E)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	19.16	112.1	0.4	0.8	0.9	556.72	
South East (S)	0.9 x	11.33	112.1	0.4	1	0.9	411.51	
South East (S GLASS DOOR)	0.9 x	2.56	112.1	0.4	0.7	0.9	65.09	
South East (E)	0.9 x	6.79	112.1	0.4	1	0.9	246.62	
						Total	1279.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476.24	457.54	465.93	
Total summer gains	1845.49	1737.49	1619.87	**(P5)**
Summer gain/loss ratio	5.24	4.94	4.6	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.64	22.2	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:22:00

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 86.4m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 25 Flat 25 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.81 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	19.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.88 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	19.17m²
Windows facing: South	11.35m²
Windows facing: West	6.79m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	86.4 m²	2.7 m

Living area:	42.37 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLASS DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	19.17	1
S	16mm or more	1	0.4	1	11.35	1
W	16mm or more	1	0.4	1	6.79	1
S GLASS DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
S GLASS DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	47.42	39.87	7.55	0.24	0	True	N/A
Internal Elements							
INT WALLS	123.12						N/A
Party Elements							
PARTY WALLS	57.11						N/A
WALLS TO CORRIDOR	23.69						N/A
PARTY CEILING	86.4						N/A

SAP Input

PARTY FLOOR 86.4 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0689

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	24.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.19	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	59.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 73.8 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.17	x 1/[1/(1)+ 0.04]		=	18.43			(27)
Windows Type 2			11.35	x 1/[1/(1)+ 0.04]		=	10.91			(27)
Windows Type 3			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	47.42	39.87	7.55	x	0.24	=	1.81			(29)
Total area of elements, m²			47.42							(31)
Party wall			57.11	x	0	=	0			(32)
Party wall			23.69	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			86.4							(32b)
Internal wall **			123.12							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.15 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.42 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	29.9	29.49	29.08	27.04	26.63	24.59	24.59	24.18	25.4	26.63	27.45	28.27	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.32	72.91	72.5	70.46	70.05	68	68	67.59	68.82	70.05	70.86	71.68	

Average = Sum(39)$_{1...12}$ /12= 70.35 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.82	0.81	0.79	0.79	0.78	0.8	0.81	0.82	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52	

Output from water heater (annual)$_{1...12}$ — 1852.23 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	75.65	66.85	70.61	63.86	62.99	56.86	55.17	59.77	59.43	66.19	69.29	74.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	154.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	51.77	45.98	37.4	28.31	21.16	17.87	19.31	25.09	33.68	42.77	49.92	53.21	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.71	350.31	341.24	321.94	297.58	274.68	259.38	255.78	264.85	284.15	308.51	331.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	53.01	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	101.69	99.48	94.91	88.7	84.66	78.98	74.15	80.34	82.54	88.97	96.23	99.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	604.65	600.25	578.03	543.43	507.88	476	457.31	465.69	485.54	520.36	559.14	588.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.35	x	46.75	x	0.4	x	1	=	147.09	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	11.35	x	76.57	x	0.4	x	1	=	240.9	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	11.35	x	97.53	x	0.4	x	1	=	306.86	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	11.35	x	110.23	x	0.4	x	1	=	346.82	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	11.35	x	114.87	x	0.4	x	1	=	361.41	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	11.35	x	110.55	x	0.4	x	1	=	347.81	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	11.35	x	108.01	x	0.4	x	1	=	339.83	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	11.35	x	104.89	x	0.4	x	1	=	330.02	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	11.35	x	101.89	x	0.4	x	1	=	320.55	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	11.35	x	82.59	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	11.35	x	55.42	x	0.4	x	1	=	174.35	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	11.35	x	40.4	x	0.4	x	1	=	127.1	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
Southwest	0.9x	0.77	x	19.17	x	36.79		0.4	x	0.8	=	156.42	(79)
Southwest	0.9x	0.77	x	19.17	x	62.67		0.4	x	0.8	=	266.43	(79)
Southwest	0.9x	0.77	x	19.17	x	85.75		0.4	x	0.8	=	364.55	(79)
Southwest	0.9x	0.77	x	19.17	x	106.25		0.4	x	0.8	=	451.69	(79)
Southwest	0.9x	0.77	x	19.17	x	119.01		0.4	x	0.8	=	505.93	(79)
Southwest	0.9x	0.77	x	19.17	x	118.15		0.4	x	0.8	=	502.27	(79)
Southwest	0.9x	0.77	x	19.17	x	113.91		0.4	x	0.8	=	484.24	(79)
Southwest	0.9x	0.77	x	19.17	x	104.39		0.4	x	0.8	=	443.78	(79)
Southwest	0.9x	0.77	x	19.17	x	92.85		0.4	x	0.8	=	394.73	(79)
Southwest	0.9x	0.77	x	19.17	x	69.27		0.4	x	0.8	=	294.47	(79)
Southwest	0.9x	0.77	x	19.17	x	44.07		0.4	x	0.8	=	187.35	(79)
Southwest	0.9x	0.77	x	19.17	x	31.49		0.4	x	0.8	=	133.86	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	363.7	617.68	838.95	1026.96	1137.26	1122.9	1085.18	1004.1	904.4	681.13	435.33	311.43	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	968.34	1217.94	1416.98	1570.38	1645.14	1598.9	1542.49	1469.79	1389.94	1201.49	994.47	900.02	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.84	0.75	0.64	0.51	0.38	0.27	0.19	0.21	0.34	0.55	0.76	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.39	20.66	20.87	20.96	20.99	21	21	20.98	20.85	20.47	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.24	20.24	20.26	20.26	20.27	20.26	20.24	20.24	20.23	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.73	0.62	0.48	0.36	0.24	0.16	0.18	0.3	0.52	0.74	0.85	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.8	20.08	20.2	20.26	20.26	20.27	20.24	20.08	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.9	20.22	20.47	20.57	20.62	20.62	20.62	20.6	20.46	20.01	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.81	0.72	0.62	0.49	0.37	0.25	0.18	0.19	0.32	0.53	0.73	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	785.75	875.95	871.79	766.16	605.17	405.95	272.91	284.63	440.33	637.96	728.19	748.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1114.66	1093.87	994.99	815.01	621.2	409.11	273.59	285.56	447.38	690.47	914.78	1092.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	959.39	(98)
Space heating requirement in kWh/m²/year	11.1	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	639.22	503.21	513.71	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	626.02	497.47	506.57	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1788.48	1725.7	1639.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	836.97	913.81	842.76	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2593.54	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	178.73	195.14	179.96	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	553.83	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	6.41	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	244.71	146.44	91.66	35.17	11.93	0	0	0	0	39.07	134.34	256.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	143.95	86.14	53.92	20.69	7.02	0	0	0	0	22.98	79.03	150.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	564.35	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.43	163.03	170.27	151.32	147.33	130.28	123.81	137.66	137.98	156.97	167.64	180.52

Total = Sum(219a)$_{1...12}$ = 1852.23 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	33.26	36.32	33.49	0	0	0	0

Total = Sum(221)$_{6...8}$ = 103.08 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		564.35	
Water heating fuel used		1852.23	
Space cooling fuel used		103.08	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	247.03		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	247.03	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3132.43	(338)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	74.44		(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0		(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0		(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	244.31		(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0		(246)
Space cooling	(221)		13.19	x 0.01 =	13.6		(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	32.58		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)		13.19	x 0.01 =	48.24		(250)
Additional standing charges (Table 12)					0		(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)...(254) =				413.17		(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.58	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	292.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	961.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1254.21	(265)
Space cooling	(221)	x	0.519	=	53.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	128.21	(267)
Electricity for lighting	(232)	x	0.519	=	189.82	(268)
Total CO2, kg/year		sum of (265)…(271) =			1625.73	(272)
CO2 emissions per m²		(272) ÷ (4) =			18.82	(273)
EI rating (section 14)					83	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1732.55	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5686.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7418.9	(265)
Space cooling	(221)	x	3.07	=	316.44	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	758.39	(267)
Electricity for lighting	(232)	x	0	=	1122.81	(268)
'Total Primary Energy		sum of (265)…(271) =			9616.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			111.3	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.39	x1/[1/(1.5)+ 0.04] =	14.7			(27)
Windows Type 2			6.15	x1/[1/(1.5)+ 0.04] =	8.7			(27)
Windows Type 3			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 4			1.39	x1/[1/(1.5)+ 0.04] =	1.97			(27)
Walls	47.42	21.61	25.81	x 0.18 =	4.65			(29)
Total area of elements, m²			47.42					(31)
Party wall			57.11	x 0 =	0			(32)
Party wall			23.69	x 0 =	0			(32)
Party floor			86.4					(32a)
Party ceiling			86.4					(32b)
Internal wall **			123.12					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16660.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.39 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.36	83.11	82.86	81.7	81.49	80.48	80.48	80.29	80.87	81.49	81.93	82.38	

Average = Sum(39)$_{1...12}$ /12= 81.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	

Output from water heater (annual)$_{1...12}$ — 2089.43 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.77	81.41	86.73	79.46	79.1	72.46	71.28	75.89	75.02	82.31	84.88	90.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.71	18.39	14.96	11.32	8.47	7.15	7.72	10.04	13.47	17.11	19.97	21.28	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	123.35	121.15	116.57	110.36	106.32	100.64	95.81	102	104.2	110.63	117.9	121.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.95	438.84	424.76	401.98	378.76	356.42	341.92	348.01	359.72	382.72	409.16	429.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.15	x	46.75	x	0.63	x	0.7	=	87.87	(78)
South	0.9x	0.77	x	1.39	x	46.75	x	0.63	x	0.7	=	19.86	(78)
South	0.9x	0.77	x	6.15	x	76.57	x	0.63	x	0.7	=	143.91	(78)
South	0.9x	0.77	x	1.39	x	76.57	x	0.63	x	0.7	=	32.53	(78)
South	0.9x	0.77	x	6.15	x	97.53	x	0.63	x	0.7	=	183.32	(78)
South	0.9x	0.77	x	1.39	x	97.53	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	6.15	x	110.23	x	0.63	x	0.7	=	207.19	(78)
South	0.9x	0.77	x	1.39	x	110.23	x	0.63	x	0.7	=	46.83	(78)
South	0.9x	0.77	x	6.15	x	114.87	x	0.63	x	0.7	=	215.9	(78)
South	0.9x	0.77	x	1.39	x	114.87	x	0.63	x	0.7	=	48.8	(78)
South	0.9x	0.77	x	6.15	x	110.55	x	0.63	x	0.7	=	207.78	(78)
South	0.9x	0.77	x	1.39	x	110.55	x	0.63	x	0.7	=	46.96	(78)
South	0.9x	0.77	x	6.15	x	108.01	x	0.63	x	0.7	=	203.01	(78)
South	0.9x	0.77	x	1.39	x	108.01	x	0.63	x	0.7	=	45.88	(78)
South	0.9x	0.77	x	6.15	x	104.89	x	0.63	x	0.7	=	197.15	(78)
South	0.9x	0.77	x	1.39	x	104.89	x	0.63	x	0.7	=	44.56	(78)
South	0.9x	0.77	x	6.15	x	101.89	x	0.63	x	0.7	=	191.5	(78)
South	0.9x	0.77	x	1.39	x	101.89	x	0.63	x	0.7	=	43.28	(78)
South	0.9x	0.77	x	6.15	x	82.59	x	0.63	x	0.7	=	155.22	(78)
South	0.9x	0.77	x	1.39	x	82.59	x	0.63	x	0.7	=	35.08	(78)
South	0.9x	0.77	x	6.15	x	55.42	x	0.63	x	0.7	=	104.16	(78)
South	0.9x	0.77	x	1.39	x	55.42	x	0.63	x	0.7	=	23.54	(78)
South	0.9x	0.77	x	6.15	x	40.4	x	0.63	x	0.7	=	75.93	(78)
South	0.9x	0.77	x	1.39	x	40.4	x	0.63	x	0.7	=	17.16	(78)
Southwest	0.9x	0.77	x	10.39	x	36.79		0.63	x	0.7	=	116.83	(79)
Southwest	0.9x	0.77	x	10.39	x	62.67		0.63	x	0.7	=	199.01	(79)
Southwest	0.9x	0.77	x	10.39	x	85.75		0.63	x	0.7	=	272.29	(79)
Southwest	0.9x	0.77	x	10.39	x	106.25		0.63	x	0.7	=	337.38	(79)
Southwest	0.9x	0.77	x	10.39	x	119.01		0.63	x	0.7	=	377.9	(79)
Southwest	0.9x	0.77	x	10.39	x	118.15		0.63	x	0.7	=	375.16	(79)
Southwest	0.9x	0.77	x	10.39	x	113.91		0.63	x	0.7	=	361.7	(79)
Southwest	0.9x	0.77	x	10.39	x	104.39		0.63	x	0.7	=	331.47	(79)
Southwest	0.9x	0.77	x	10.39	x	92.85		0.63	x	0.7	=	294.83	(79)
Southwest	0.9x	0.77	x	10.39	x	69.27		0.63	x	0.7	=	219.95	(79)
Southwest	0.9x	0.77	x	10.39	x	44.07		0.63	x	0.7	=	139.94	(79)
Southwest	0.9x	0.77	x	10.39	x	31.49		0.63	x	0.7	=	99.98	(79)
West	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(80)
West	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(80)
West	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(80)
West	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(80)
West	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(80)

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West	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(80)
West	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(80)
West	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(80)
West	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(80)
West	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(80)
West	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	246.65	418.66	568.2	695.18	769.79	760.1	734.55	679.66	612.37	461.52	295.18	211.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	687.6	857.5	992.97	1097.16	1148.55	1116.52	1076.47	1027.67	972.09	844.24	704.34	640.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.81	0.64	0.46	0.33	0.36	0.56	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.43	20.68	20.88	20.97	21	21	21	20.99	20.86	20.49	20.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.77	0.59	0.4	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.39	19.73	20.01	20.11	20.14	20.14	20.14	20.13	19.99	19.49	19.01	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.9	20.2	20.44	20.53	20.56	20.56	20.56	20.55	20.42	19.98	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.9	0.78	0.61	0.43	0.3	0.32	0.53	0.83	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	678.71	824.54	897.7	859.01	702.07	477.86	318.69	333.96	515.68	701.7	681.2	634.43	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.09	1246.83	1134.93	942.59	719.75	479.62	318.85	334.23	521.74	799.82	1055.3	1266.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1791.26	(98)
Space heating requirement in kWh/m²/year	20.73	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
445.19	283.78	176.5	60.18	13.16	0	0	0	0	73.01	269.35	470.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
476.14	303.51	188.77	64.36	14.07	0	0	0	0	78.08	288.08	502.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1915.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)												
205.57	181.23	190.42	170.81	167.48	149.77	143.96	157.8	157.47	177.12	187.13	200.67	
Efficiency of water heater											79.8	(216)
(217)m=	86.82	86.01	84.61	82.34	80.49	79.8	79.8	79.8	79.8	82.65	85.78	87.01	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	236.77	210.72	225.04	207.46	208.06	187.68	180.4	197.75	197.34	214.29	218.15	230.63	

Total = Sum(219a)$_{1...12}$ =	2514.29	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1915.79	
Water heating fuel used		2514.29	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		365.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4870.81	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	413.81	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.82	(268)
Total CO2, kg/year	sum of (265)…(271) =			1185.64	(272)

TER = 19.81 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	307.93	**(P1)**
Transmission heat loss coefficient:	43.4	
Summer heat loss coefficient:	351.35	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
South (S)	0	1
West (W)	0	1
South (S GLASS DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S GLASS DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	19.17	112.1	0.4	0.8	0.9	557.02	
South (S)	0.9 x	11.35	106.3	0.4	1	0.9	390.9	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S GLASS DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1248.26	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	476	457.31	465.69	
Total summer gains	1808.16	1705.57	1601.94	**(P5)**
Summer gain/loss ratio	5.15	4.85	4.56	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.15	22.55	22.16	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:52

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 37.9m²

Site Reference : P1785 St Michaels

Plot Reference: Level 25 Flat 25 09

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.16 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.51 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.5 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.83 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	16.53m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 25 Flat 25 09

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.9 m²	2.7 m

Living area:	18.71 m² (fraction 0.494)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SW	16mm or more	0.8	0.4	1	16.53	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	16.53	4.59	0.24	0	True	N/A
Internal Elements							
INT WALLS	47.52						N/A
Party Elements							
PARTY WALLS	36.74						N/A
WALLS TO CORRIDOR	15.68						N/A
PARTY CEILING	37.9						N/A
PARTY FLOOR	37.9						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1024

	Length	Psi-value		
[Approved]	14.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.82	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.45 (fraction 0.856)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			16.53	x 1/[1/(1)+ 0.04]		=	15.89			(27)
Walls	21.12	16.53	4.59	x	0.24	=	1.1			(29)
Total area of elements, m²			21.12							(31)
Party wall			36.74	x	0	=	0			(32)
Party wall			15.68	x	0	=	0			(32)
Party floor			37.9							(32a)
Party ceiling			37.9							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.31	12.15	11.98	11.16	11	10.18	10.18	10.02	10.51	11	11.33	11.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.47	31.3	31.14	30.32	30.16	29.34	29.34	29.18	29.67	30.16	30.49	30.81	

Average = Sum(39)$_{1...12}$ /12= 30.28 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.82	0.8	0.8	0.77	0.77	0.77	0.78	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46	

Output from water heater (annual)$_{1...12}$ 1275.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.74	45.7	48.23	43.56	42.92	38.69	37.48	40.69	40.48	45.15	47.34	50.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.92	23.02	18.72	14.17	10.59	8.94	9.66	12.56	16.86	21.41	24.99	26.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.57	175.37	170.83	161.17	148.97	137.51	129.85	128.05	132.59	142.25	154.45	165.91	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	44.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	69.54	68.01	64.82	60.5	57.69	53.74	50.38	54.69	56.22	60.69	65.74	68.01	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.52	337.89	325.87	307.34	288.76	271.69	261.39	266.79	277.16	295.85	316.68	332.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	16.53	x	11.28	x	0.4	x	0.8	=	41.36	(81)
Northwest 0.9x	0.77	x	16.53	x	22.97	x	0.4	x	0.8	=	84.19	(81)
Northwest 0.9x	0.77	x	16.53	x	41.38	x	0.4	x	0.8	=	151.68	(81)
Northwest 0.9x	0.77	x	16.53	x	67.96	x	0.4	x	0.8	=	249.11	(81)
Northwest 0.9x	0.77	x	16.53	x	91.35	x	0.4	x	0.8	=	334.85	(81)

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Northwest	0.9x	0.77	x	16.53	x	97.38	x	0.4	x	0.8	=	356.98	(81)
Northwest	0.9x	0.77	x	16.53	x	91.1	x	0.4	x	0.8	=	333.95	(81)
Northwest	0.9x	0.77	x	16.53	x	72.63	x	0.4	x	0.8	=	266.23	(81)
Northwest	0.9x	0.77	x	16.53	x	50.42	x	0.4	x	0.8	=	184.83	(81)
Northwest	0.9x	0.77	x	16.53	x	28.07	x	0.4	x	0.8	=	102.89	(81)
Northwest	0.9x	0.77	x	16.53	x	14.2	x	0.4	x	0.8	=	52.04	(81)
Northwest	0.9x	0.77	x	16.53	x	9.21	x	0.4	x	0.8	=	33.78	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.36	84.19	151.68	249.11	334.85	356.98	333.95	266.23	184.83	102.89	52.04	33.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	381.88	422.08	477.55	556.44	623.6	628.67	595.34	533.02	461.99	398.73	368.72	365.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.74	0.59	0.43	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.18	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.35	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.26	20.28	20.28	20.28	20.27	20.26	20.25	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.86	0.81	0.72	0.56	0.4	0.26	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.16	19.59	20.01	20.19	20.26	20.27	20.28	20.23	19.96	19.41	18.85	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.66	20.03	20.4	20.56	20.62	20.63	20.63	20.59	20.35	19.87	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.71	0.57	0.41	0.28	0.2	0.23	0.4	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	320.66	336.67	341.44	316.82	257.91	174.98	117.87	122.8	186.5	255.82	290.58	311.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	475.64	462.13	421.34	348.73	267.26	176.7	118.27	123.45	192.53	294.12	389.45	468.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	505.54	(98)
Space heating requirement in kWh/m²/year	13.34	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	275.82	217.13	221.76	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	268.27	213.62	216.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	688.94	651.72	577.97	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	302.88	325.95	268.98	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	897.81	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	64.83	69.77	57.57	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	192.18	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.07	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	115.31	84.3	59.44	22.98	6.96	0	0	0	0	28.5	71.18	116.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	67.83	49.59	34.97	13.52	4.09	0	0	0	0	16.76	41.87	68.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	297.37	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.87	112.4	117.33	104.18	101.37	89.54	85.01	94.64	94.9	108.08	115.54	124.46

Total = Sum(219a)$_{1...12}$ = 1275.35 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	12.07	12.99	10.72	0	0	0	0

Total = Sum(221)$_{6...8}$ = 35.77 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		297.37	
Water heating fuel used		1275.35	
Space cooling fuel used		35.77	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.36		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.36	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1899.94	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	39.22	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.22	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.72	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.29	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.15	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				250.6	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.29	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	154.34	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	661.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				816.24	(265)
Space cooling	(221) x		0.519	=	18.56	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.24	(267)
Electricity for lighting	(232) x		0.519	=	95.02	(268)
Total CO2, kg/year		sum of (265)…(271) =			986.07	(272)
CO2 emissions per m²		(272) ÷ (4) =			26.02	(273)
EI rating (section 14)					84	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	912.94	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3915.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4828.25	(265)
Space cooling	(221) x		3.07	=	109.8	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	332.68	(267)
Electricity for lighting	(232) x		0	=	562.09	(268)
‘Total Primary Energy		sum of (265)…(271) =			5832.82	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.9	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 09

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.9	(1a) x	2.7	(2a) =	102.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.48	x 1/[1/(1.5)+ 0.04] =	13.42			(27)
Walls	21.12	9.48	11.64	x 0.18 =	2.1			(29)
Total area of elements, m²			21.12					(31)
Party wall			36.74	x 0 =	0			(32)
Party wall			15.68	x 0 =	0			(32)
Party floor			37.9					(32a)
Party ceiling			37.9					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3459.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.16	20.03	19.9	19.32	19.21	18.7	18.7	18.61	18.9	19.21	19.43	19.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.83	37.7	37.58	36.99	36.88	36.37	36.37	36.28	36.57	36.88	37.1	37.34	

Average = Sum(39)$_{1...12}$ /12= 36.99 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.96	0.97	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.93	70.28	67.63	64.98	62.32	59.67	59.67	62.32	64.98	67.63	70.28	72.93

Total = Sum(44)$_{1...12}$ = 795.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.16	94.6	97.61	85.1	81.66	70.46	65.3	74.93	75.82	88.36	96.46	104.75

Total = Sum(45)$_{1...12}$ = 1043.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.22	14.19	14.64	12.77	12.25	10.57	9.79	11.24	11.37	13.25	14.47	15.71

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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TER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Output from water heater (annual)$_{1...12}$ 1584.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.72	64.66	69.22	63.87	63.91	59.01	58.47	61.68	60.79	66.14	67.65	71.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	67.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.37	9.21	7.49	5.67	4.24	3.58	3.87	5.03	6.74	8.56	10	10.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.29	117.5	114.46	107.98	99.81	92.13	87	85.79	88.83	95.31	103.48	111.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	29.76	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	-54.07	(71)

Water heating gains (Table 5)

(72)m=	97.75	96.22	93.04	88.71	85.9	81.95	78.59	82.9	84.43	88.9	93.96	96.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.68	269.2	261.26	248.64	236.23	223.94	215.73	219.99	226.28	239.05	253.71	264.31	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.48	x	11.28	x	0.63	x	0.7	=	32.69	(81)
Northwest 0.9x	0.77	x	9.48	x	22.97	x	0.63	x	0.7	=	66.54	(81)
Northwest 0.9x	0.77	x	9.48	x	41.38	x	0.63	x	0.7	=	119.88	(81)
Northwest 0.9x	0.77	x	9.48	x	67.96	x	0.63	x	0.7	=	196.88	(81)
Northwest 0.9x	0.77	x	9.48	x	91.35	x	0.63	x	0.7	=	264.65	(81)

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Northwest	0.9x	0.77	x	9.48	x	97.38	x	0.63	x	0.7	=	282.14	(81)
Northwest	0.9x	0.77	x	9.48	x	91.1	x	0.63	x	0.7	=	263.94	(81)
Northwest	0.9x	0.77	x	9.48	x	72.63	x	0.63	x	0.7	=	210.42	(81)
Northwest	0.9x	0.77	x	9.48	x	50.42	x	0.63	x	0.7	=	146.08	(81)
Northwest	0.9x	0.77	x	9.48	x	28.07	x	0.63	x	0.7	=	81.32	(81)
Northwest	0.9x	0.77	x	9.48	x	14.2	x	0.63	x	0.7	=	41.13	(81)
Northwest	0.9x	0.77	x	9.48	x	9.21	x	0.63	x	0.7	=	26.7	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.69	66.54	119.88	196.88	264.65	282.14	263.94	210.42	146.08	81.32	41.13	26.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.37	335.74	381.14	445.52	500.88	506.08	479.67	430.41	372.36	320.37	294.84	291.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.85	0.66	0.46	0.33	0.39	0.65	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.29	20.54	20.83	20.97	21	21	21	20.98	20.77	20.42	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.09	20.09	20.1	20.11	20.12	20.12	20.12	20.11	20.11	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.6	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.98	19.18	19.53	19.92	20.08	20.11	20.12	20.12	20.1	19.86	19.37	18.95	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.73	20.03	20.37	20.52	20.55	20.55	20.55	20.53	20.31	19.89	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.61	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.49	327.97	359.3	369.8	315.13	215.54	143.68	150.46	228.86	286.72	287.22	287.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	577.22	559.06	508.29	424.2	325.15	216.43	143.77	150.68	235.17	358.06	474.56	572.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.17	(98)
Space heating requirement in kWh/m²/year	24.25	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
206.64	155.29	110.85	39.17	7.46	0	0	0	0	53.07	134.89	211.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
221	166.09	118.56	41.89	7.97	0	0	0	0	56.76	144.26	226.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	983.07	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

Water heating

Output from water heater (calculated above)

154.11	136.1	143.57	129.57	127.61	114.93	111.25	120.88	120.29	134.32	140.93	150.7	

Efficiency of water heater	79.8	(216)

(217)m=	85.6	85.17	84.13	82.05	80.32	79.8	79.8	79.8	79.8	82.56	84.7	85.72	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.04	159.81	170.64	157.92	158.87	144.03	139.41	151.48	150.74	162.68	166.39	175.8

Total = Sum(219a)$_{1...12}$ =	1917.8	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		983.07	
Water heating fuel used		1917.8	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		183.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3158.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	212.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			626.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			760.54	(272)

TER = 29.16 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 09

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.08	**(P1)**
Transmission heat loss coefficient:	19.2	
Summer heat loss coefficient:	154.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (SW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (SW)	0.9 x	16.53	89.66	0.4	0.8	0.9	384.13	
						Total	384.13	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.69	261.39	266.79	
Total summer gains	695.2	645.53	568.06	**(P5)**
Summer gain/loss ratio	4.51	4.19	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.89	21.28	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:45

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.58m²

Site Reference : P1785 St Michaels

Plot Reference: Level 25 Flat 25 10

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	24.71 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.26 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 10

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.58 m²	2.7 m

Living area:	30.72 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.27	3.12	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.13						N/A
WALLS TO CORRIDOR	22.53						N/A
PARTY CEILING	50.58						N/A
PARTY FLOOR	50.58						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0777

	Length	Psi-value		
[Approved]	10.22	0.05	E4	Jamb
[Approved]	11.51	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.9	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.62 (fraction 0.862)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	22.39	19.27	3.12	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.13	x	0	=	0			(32)
Party wall			22.53	x	0	=	0			(32)
Party floor			50.58							(32a)
Party ceiling			50.58							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.21	15.99	14.9	14.68	13.59	13.59	13.37	14.03	14.68	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.01	35.92	35.7	34.61	34.61	34.39	35.04	35.7	36.14	36.57	

Average = Sum(39)$_{1...12}$ /12= 35.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Output from water heater (annual)$_{1...12}$ | 1408.18 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.31	49.7	52.36	47.16	46.38	41.68	40.25	43.86	43.69	48.9	51.42	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	102.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.15	29.44	23.95	18.13	13.55	11.44	12.36	16.07	21.57	27.38	31.96	34.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222	224.3	218.5	206.14	190.54	175.88	166.08	163.78	169.58	181.94	197.54	212.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	75.69	73.97	70.38	65.51	62.34	57.88	54.1	58.95	60.67	65.72	71.42	73.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.94	408.81	393.92	370.87	347.53	326.3	313.64	319.89	332.92	356.14	382.01	401.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x 0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)

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North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	75.85	147.93	244.62	361.52	449.33	463.24	439.65	373.08	285.76	175.61	94.45	62.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	487.79	556.74	638.53	732.38	796.86	789.53	753.28	692.97	618.68	531.75	476.46	463.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	0.86	0.81	0.71	0.55	0.41	0.28	0.2	0.23	0.38	0.63	0.8	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.16	20.38	20.65	20.88	20.97	20.99	21	21	20.98	20.84	20.5	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.79	0.69	0.53	0.38	0.25	0.17	0.2	0.35	0.6	0.78	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.19	19.5	19.87	20.19	20.3	20.35	20.35	20.36	20.33	20.15	19.69	19.17	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	20.03	20.34	20.61	20.7	20.74	20.75	20.75	20.72	20.57	20.18	19.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.84	0.78	0.69	0.54	0.39	0.27	0.19	0.22	0.37	0.61	0.78	0.85	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	409.55	436.03	438.61	394.22	314.17	211.32	143.22	149.08	228.13	323.4	371.24	395.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	579.63	563.42	512.32	420.42	321.42	212.52	143.46	149.47	232.13	355.99	472.75	568.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 517.63 (98)

Space heating requirement in kWh/m²/year 10.23 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.31	256.1	261.36	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	319.9	253.8	258.06	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	867.74	827.51	755.96	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	394.44	426.84	370.44	0	0	0	0	

Total = Sum(104) = 1191.72 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	85.04	92.03	79.87	0	0	0	0

Total = Sum(107) = 256.93 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.08 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	126.54	85.61	54.84	18.87	5.4	0	0	0	0	24.24	73.09	129.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	74.43	50.36	32.26	11.1	3.17	0	0	0	0	14.26	42.99	75.91	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 304.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.65	124.45	129.76	115.02	111.77	98.52	93.33	104.18	104.56	119.33	127.82	137.8	

Total = Sum(219a)$_{1...12}$ = 1408.18 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	15.83	17.13	14.86	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 47.82 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		304.49
Water heating fuel used		1408.18
Space cooling fuel used		47.82

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.62	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.62	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2139.29	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	40.16	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.74	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.31	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.89	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					282.17	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)	82.7	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	158.03	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =					888.87	(265)
Space cooling	(221)	x		0.519	=	24.82	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.06	(267)

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Electricity for lighting	(232) x	0.519	=	121.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1110.29	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.95	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		3.07	=	934.77	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	4323.12	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5257.89	(265)
Space cooling	(221) x		3.07	=	146.81	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	443.98	(267)
Electricity for lighting	(232) x		0	=	718.94	(268)
'Total Primary Energy	sum of (265)…(271) =				6567.61	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				129.85	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.58	(1a) x	2.7	(2a) =	136.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.93	x1/[1/(1.5)+ 0.04] =	14.05			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.75			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.13	x 0 =	0			(32)
Party wall			22.53	x 0 =	0			(32)
Party floor			50.58					(32a)
Party ceiling			50.58					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4503.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.28 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	25.99	25.86	25.73	25.11	24.99	24.45	24.45	24.35	24.66	24.99	25.23	25.47	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.27	47.14	47.01	46.39	46.27	45.74	45.74	45.64	45.94	46.27	46.51	46.75	

Average = Sum(39)$_{1...12}$ /12= 46.39 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.75 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.22	79.23	76.24	73.25	70.26	67.27	67.27	70.26	73.25	76.24	79.23	82.22	

Total = Sum(44)$_{1...12}$ = 896.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.93	106.64	110.04	95.94	92.06	79.44	73.61	84.47	85.48	99.62	108.74	118.08	

Total = Sum(45)$_{1...12}$ = 1176.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.94	16.31	17.71	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5	

Output from water heater (annual)$_{1...12}$ | 1722.51 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.67	68.99	73.72	67.83	67.74	62.35	61.61	65.22	64.35	70.25	72.09	76.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	85.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.94	6.43	8.63	10.95	12.78	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.74	150.28	146.39	138.11	127.66	117.84	111.28	109.73	113.62	121.9	132.35	142.18	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	-68.29	(71)

Water heating gains (Table 5)

(72)m=	104.4	102.67	99.09	94.21	91.05	86.59	82.8	87.66	89.38	94.42	100.12	102.68	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.01	316.34	306.67	291.18	275.74	260.61	250.63	255.42	263.24	278.89	296.87	310.09	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x 0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)

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North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
West	0.9x	0.77	x	9.93	x	19.64	x	0.63	x	0.7	=	59.6	(80)
West	0.9x	0.77	x	9.93	x	38.42	x	0.63	x	0.7	=	116.6	(80)
West	0.9x	0.77	x	9.93	x	63.27	x	0.63	x	0.7	=	192.02	(80)
West	0.9x	0.77	x	9.93	x	92.28	x	0.63	x	0.7	=	280.05	(80)
West	0.9x	0.77	x	9.93	x	113.09	x	0.63	x	0.7	=	343.21	(80)
West	0.9x	0.77	x	9.93	x	115.77	x	0.63	x	0.7	=	351.33	(80)
West	0.9x	0.77	x	9.93	x	110.22	x	0.63	x	0.7	=	334.48	(80)
West	0.9x	0.77	x	9.93	x	94.68	x	0.63	x	0.7	=	287.32	(80)
West	0.9x	0.77	x	9.93	x	73.59	x	0.63	x	0.7	=	223.32	(80)
West	0.9x	0.77	x	9.93	x	45.59	x	0.63	x	0.7	=	138.35	(80)
West	0.9x	0.77	x	9.93	x	24.49	x	0.63	x	0.7	=	74.32	(80)
West	0.9x	0.77	x	9.93	x	16.15	x	0.63	x	0.7	=	49.01	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.41	133.43	220.62	325.98	405.09	417.58	396.33	336.38	257.71	158.39	85.18	56.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.42	449.77	527.28	617.17	680.82	678.19	646.96	591.81	520.94	437.27	382.05	366.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.81	0.62	0.43	0.31	0.35	0.6	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.39	20.64	20.89	20.98	21	21	21	20.99	20.83	20.47	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.78	0.57	0.37	0.25	0.29	0.53	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.1	19.35	19.71	20.03	20.14	20.16	20.16	20.17	20.15	19.97	19.49	19.06	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.98	20.28	20.55	20.65	20.67	20.67	20.67	20.66	20.49	20.09	19.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.8	0.6	0.41	0.29	0.33	0.57	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.29	438.54	489.67	490.93	405.91	276.93	186.15	194.81	296.77	383.56	372.83	363.46	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.73	710.82	647.56	540.5	414.13	277.62	186.22	194.96	301.38	457.68	603.99	726.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1094.09 (98)

Space heating requirement in kWh/m²/year 21.63 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	259.98	182.97	117.47	35.68	6.12	0	0	0	0	55.14	166.43	270.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	278.05	195.69	125.64	38.17	6.54	0	0	0	0	58.98	178	289.09	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1170.15 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.34	148.56	156.46	140.85	138.47	124.35	120.02	130.88	130.39	146.03	153.65	164.5

Efficiency of water heater 79.8 (216)

(217)m=	85.97	85.37	84.06	81.75	80.2	79.8	79.8	79.8	79.8	82.47	85.03	86.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.82	174.02	186.12	172.29	172.65	155.83	150.4	164.01	163.4	177.06	180.71	190.98

Total = Sum(219a)$_{1...12}$ = 2083.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1170.15	
Water heating fuel used		2083.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.18	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3562.63	(338)

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12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	252.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				702.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			863.21	(272)

TER = 24.71 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 10

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.27	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.28	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	505.72	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.3	313.64	319.89	
Total summer gains	875.86	819.35	742.08	**(P5)**
Summer gain/loss ratio	4.35	4.07	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.35	21.77	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:38

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 50.6m²

Site Reference : P1785 St Michaels

Plot Reference: Level 25 Flat 25 11

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	23.88 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	22.79 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.7 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.89 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.87 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	15.14m²
Windows facing: South	1.57m²
Windows facing: South	2.55m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 25 Flat 25 11

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	50.6 m²	2.7 m

Living area:	30.71 m² (fraction 0.607)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
W	16mm or more	0.8	0.4	1	15.14	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.55	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	22.39	19.26	3.13	0.24	0	True	N/A
Internal Elements							
INT WALL	50.76						N/A
Party Elements							
PARTY WALLS	42.15						N/A
WALLS TO CORRIDOR	22.55						N/A
PARTY CEILING	50.62						N/A
PARTY FLOOR	50.62						N/A

Thermal bridges:

SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0781

	Length	Psi-value		
[Approved]	10.21	0.05	E4	Jamb
[Approved]	11.63	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.92	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: False

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 3.98
Compressor control: Systems with variable speed compressors
Cooled area: 43.25 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 148 litres
Cylinder insulation: Measured loss, 1.06kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

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SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			15.14	x 1/[1/(1)+ 0.04]		=	14.56			(27)
Windows Type 2			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 3			2.55	x 1/[1/(1)+ 0.04]		=	2.45			(27)
Walls	22.39	19.26	3.13	x	0.24	=	0.75			(29)
Total area of elements, m²			22.39							(31)
Party wall			42.15	x	0	=	0			(32)
Party wall			22.55	x	0	=	0			(32)
Party floor			50.62							(32a)
Party ceiling			50.62							(32b)
Internal wall **			50.76							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.02 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	16.43	16.22	16	14.91	14.69	13.6	13.6	13.38	14.03	14.69	15.12	15.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.45	37.23	37.02	35.92	35.71	34.61	34.61	34.4	35.05	35.71	36.14	36.58	

Average = Sum(39)$_{1...12}$ /12= 35.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.68	0.68	0.68	0.69	0.71	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 148 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Output from water heater (annual)$_{1...12}$ | 1408.4 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	56.32	49.71	52.37	47.17	46.39	41.68	40.25	43.86	43.69	48.9	51.43	55.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	33.16	29.45	23.95	18.13	13.56	11.44	12.37	16.07	21.57	27.39	31.97	34.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	222.08	224.38	218.58	206.21	190.61	175.94	166.14	163.84	169.64	182.01	197.61	212.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	46.95	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	75.7	73.97	70.39	65.51	62.35	57.89	54.1	58.96	60.68	65.73	71.43	73.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.05	408.92	394.03	370.97	347.62	326.38	313.72	319.98	333.01	356.24	382.12	401.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x 0.77	x	2.55	x	46.75	x	0.4	x	0.7	=	23.13	(78)

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South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.4	x	0.7	=	37.89	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.4	x	0.7	=	48.26	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.4	x	0.7	=	54.54	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.4	x	0.7	=	56.84	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.4	x	0.7	=	54.7	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.4	x	0.7	=	53.44	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.4	x	0.7	=	51.9	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.4	x	0.7	=	50.41	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.4	x	0.7	=	40.86	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.4	x	0.7	=	27.42	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.4	x	0.7	=	19.99	(78)
West	0.9x	0.77	x	15.14	x	19.64	x	0.4	x	0.8	=	65.94	(80)
West	0.9x	0.77	x	15.14	x	38.42	x	0.4	x	0.8	=	128.99	(80)
West	0.9x	0.77	x	15.14	x	63.27	x	0.4	x	0.8	=	212.44	(80)
West	0.9x	0.77	x	15.14	x	92.28	x	0.4	x	0.8	=	309.83	(80)
West	0.9x	0.77	x	15.14	x	113.09	x	0.4	x	0.8	=	379.7	(80)
West	0.9x	0.77	x	15.14	x	115.77	x	0.4	x	0.8	=	388.69	(80)
West	0.9x	0.77	x	15.14	x	110.22	x	0.4	x	0.8	=	370.05	(80)
West	0.9x	0.77	x	15.14	x	94.68	x	0.4	x	0.8	=	317.87	(80)
West	0.9x	0.77	x	15.14	x	73.59	x	0.4	x	0.8	=	247.07	(80)
West	0.9x	0.77	x	15.14	x	45.59	x	0.4	x	0.8	=	153.06	(80)
West	0.9x	0.77	x	15.14	x	24.49	x	0.4	x	0.8	=	82.22	(80)
West	0.9x	0.77	x	15.14	x	16.15	x	0.4	x	0.8	=	54.23	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.42	200.2	303.14	412.34	486.53	491.5	470.5	415.42	341.83	229.87	133.76	91.8

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.47	609.13	697.17	783.31	834.15	817.89	784.22	735.4	674.84	586.11	515.88	493.25

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	0.84	0.77	0.67	0.52	0.39	0.27	0.19	0.21	0.35	0.58	0.77	0.86	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.47	20.71	20.9	20.97	20.99	21	21	20.98	20.88	20.57	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.34	20.35	20.35	20.36	20.35	20.34	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.83	0.75	0.65	0.5	0.36	0.24	0.17	0.18	0.32	0.55	0.75	0.84	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.3	19.62	19.95	20.21	20.3	20.35	20.35	20.36	20.33	20.19	19.78	19.27	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.87	20.14	20.41	20.63	20.71	20.74	20.75	20.75	20.73	20.61	20.26	19.84	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.82	0.75	0.65	0.51	0.38	0.26	0.18	0.2	0.34	0.57	0.75	0.83	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427.13	456.9	453.06	399.24	315.31	211.5	143.27	149.18	229.28	331.51	386.56	411.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	582.99	567.27	514.86	421.28	321.63	212.57	143.49	149.5	232.33	357.33	475.51	572.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 459.23 (98)

Space heating requirement in kWh/m²/year 9.08 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	325.37	256.14	261.41	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	320.56	254.15	258.72	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	900.87	863.66	805.53	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	417.82	453.48	406.83	0	0	0	0	

Total = Sum(104) = 1278.13 (104)

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Cooled fraction — f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	89.28	96.9	86.93	0	0	0	0

Total = Sum(107) = 273.12 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 5.4 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.37 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	115.96	74.17	45.99	15.86	4.71	0	0	0	0	19.22	64.04	119.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	68.21	43.63	27.05	9.33	2.77	0	0	0	0	11.3	37.67	70.18	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 270.14 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	141.67	124.47	129.78	115.04	111.79	98.53	93.34	104.2	104.57	119.35	127.84	137.82	

Total = Sum(219a)$_{1...12}$ = 1408.4 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	16.62	18.03	16.18	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 50.83 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		270.14
Water heating fuel used		1408.4
Space cooling fuel used		50.83

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Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		144.68	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	144.68	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.31	(338)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	35.63	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)							
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1				(243)
Low-rate fraction	1.0 – (243) =		0				(244)
High-rate cost	(219) x (243) x			13.19	x 0.01 =	185.77	(245)
Low-rate cost	(219) x (244) x			13.19	x 0.01 =	0	(246)
Space cooling	(221)			13.19	x 0.01 =	6.7	(248)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	19.08	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a							
Energy for lighting	(232)			13.19	x 0.01 =	30.9	(250)
Additional standing charges (Table 12)						0	(251)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					278.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.22	(257)
SAP rating (Section 12)	82.96	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x		0.519	=	140.2	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	730.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =					871.16	(265)
Space cooling	(221)	x		0.519	=	26.38	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	75.09	(267)

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Electricity for lighting	(232) x	0.519	=	121.58	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.21	(272)
CO2 emissions per m²	(272) ÷ (4) =			21.62	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	829.32	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	4323.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5153.11	(265)
Space cooling	(221) x	3.07	=	156.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	444.15	(267)
Electricity for lighting	(232) x	0	=	719.19	(268)
'Total Primary Energy	sum of (265)…(271) =			6472.51	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			127.92	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.6	(1a) x	2.7	(2a) =	136.62	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.6	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.62	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.94	x1/[1/(1.5)+ 0.04] =	14.07			(27)
Windows Type 2			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Windows Type 3			1.67	x1/[1/(1.5)+ 0.04] =	2.36			(27)
Walls	22.39	12.64	9.75	x 0.18 =	1.76			(29)
Total area of elements, m²			22.39					(31)
Party wall			42.15	x 0 =	0			(32)
Party wall			22.55	x 0 =	0			(32)
Party floor			50.62					(32a)
Party ceiling			50.62					(32b)
Internal wall **			50.76					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 19.64 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4506.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	26	25.87	25.73	25.12	25	24.46	24.46	24.36	24.67	25	25.23	25.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	47.29	47.16	47.03	46.41	46.29	45.75	45.75	45.65	45.96	46.29	46.53	46.77	

Average = Sum(39)$_{1...12}$ /12= 46.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.92	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.92 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.76 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.24	79.25	76.25	73.26	70.27	67.28	67.28	70.27	73.26	76.25	79.25	82.24	

Total = Sum(44)$_{1...12}$ = 897.12 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.95	106.66	110.06	95.96	92.07	79.45	73.62	84.48	85.49	99.63	108.76	118.11	

Total = Sum(45)$_{1...12}$ = 1176.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.29	16	16.51	14.39	13.81	11.92	11.04	12.67	12.82	14.95	16.31	17.72	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.38 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.15	20.91	23.15	22.4	23.15	22.4	23.15	23.15	22.4	23.15	22.4	23.15	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52	

Output from water heater (annual)$_{1...12}$ | 1722.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.68	69	73.73	67.84	67.74	62.35	61.61	65.22	64.36	70.26	72.09	76.4	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	85.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.26	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.79	150.34	146.45	138.16	127.71	117.88	111.31	109.77	113.66	121.94	132.4	142.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	-68.31	(71)

Water heating gains (Table 5)

(72)m=	104.41	102.68	99.09	94.22	91.05	86.6	82.81	87.66	89.39	94.43	100.13	102.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.08	316.42	306.74	291.25	275.8	260.67	250.69	255.48	263.29	278.95	296.94	310.17	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	1.03	x	46.75	x	0.63	x	0.7	=	14.72	(78)
South	0.9x 0.77	x	1.67	x	46.75	x	0.63	x	0.7	=	23.86	(78)

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South	0.9x	0.77	x	1.03	x	76.57	x	0.63	x	0.7	=	24.1	(78)
South	0.9x	0.77	x	1.67	x	76.57	x	0.63	x	0.7	=	39.08	(78)
South	0.9x	0.77	x	1.03	x	97.53	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.67	x	97.53	x	0.63	x	0.7	=	49.78	(78)
South	0.9x	0.77	x	1.03	x	110.23	x	0.63	x	0.7	=	34.7	(78)
South	0.9x	0.77	x	1.67	x	110.23	x	0.63	x	0.7	=	56.26	(78)
South	0.9x	0.77	x	1.03	x	114.87	x	0.63	x	0.7	=	36.16	(78)
South	0.9x	0.77	x	1.67	x	114.87	x	0.63	x	0.7	=	58.63	(78)
South	0.9x	0.77	x	1.03	x	110.55	x	0.63	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.67	x	110.55	x	0.63	x	0.7	=	56.42	(78)
South	0.9x	0.77	x	1.03	x	108.01	x	0.63	x	0.7	=	34	(78)
South	0.9x	0.77	x	1.67	x	108.01	x	0.63	x	0.7	=	55.13	(78)
South	0.9x	0.77	x	1.03	x	104.89	x	0.63	x	0.7	=	33.02	(78)
South	0.9x	0.77	x	1.67	x	104.89	x	0.63	x	0.7	=	53.54	(78)
South	0.9x	0.77	x	1.03	x	101.89	x	0.63	x	0.7	=	32.07	(78)
South	0.9x	0.77	x	1.67	x	101.89	x	0.63	x	0.7	=	52	(78)
South	0.9x	0.77	x	1.03	x	82.59	x	0.63	x	0.7	=	26	(78)
South	0.9x	0.77	x	1.67	x	82.59	x	0.63	x	0.7	=	42.15	(78)
South	0.9x	0.77	x	1.03	x	55.42	x	0.63	x	0.7	=	17.44	(78)
South	0.9x	0.77	x	1.67	x	55.42	x	0.63	x	0.7	=	28.28	(78)
South	0.9x	0.77	x	1.03	x	40.4	x	0.63	x	0.7	=	12.72	(78)
South	0.9x	0.77	x	1.67	x	40.4	x	0.63	x	0.7	=	20.62	(78)
West	0.9x	0.77	x	9.94	x	19.64	x	0.63	x	0.7	=	59.66	(80)
West	0.9x	0.77	x	9.94	x	38.42	x	0.63	x	0.7	=	116.71	(80)
West	0.9x	0.77	x	9.94	x	63.27	x	0.63	x	0.7	=	192.21	(80)
West	0.9x	0.77	x	9.94	x	92.28	x	0.63	x	0.7	=	280.33	(80)
West	0.9x	0.77	x	9.94	x	113.09	x	0.63	x	0.7	=	343.55	(80)
West	0.9x	0.77	x	9.94	x	115.77	x	0.63	x	0.7	=	351.69	(80)
West	0.9x	0.77	x	9.94	x	110.22	x	0.63	x	0.7	=	334.82	(80)
West	0.9x	0.77	x	9.94	x	94.68	x	0.63	x	0.7	=	287.61	(80)
West	0.9x	0.77	x	9.94	x	73.59	x	0.63	x	0.7	=	223.55	(80)
West	0.9x	0.77	x	9.94	x	45.59	x	0.63	x	0.7	=	138.49	(80)
West	0.9x	0.77	x	9.94	x	24.49	x	0.63	x	0.7	=	74.39	(80)
West	0.9x	0.77	x	9.94	x	16.15	x	0.63	x	0.7	=	49.06	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	98.24	179.89	272.69	371.29	438.34	442.91	423.95	374.16	307.62	206.64	120.12	82.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	496.31	579.43	662.54	714.14	703.58	674.63	629.64	570.91	485.59	417.06	392.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.78	0.59	0.42	0.3	0.33	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.46	20.71	20.91	20.98	21	21	21	20.99	20.87	20.53	20.23	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.9	0.74	0.54	0.36	0.24	0.27	0.48	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.18	19.46	19.8	20.06	20.14	20.16	20.16	20.17	20.16	20.02	19.57	19.13	(90)

fLA = Living area ÷ (4) = 0.61 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.84	20.07	20.35	20.58	20.65	20.67	20.67	20.67	20.66	20.54	20.15	19.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.96	0.9	0.76	0.57	0.39	0.28	0.31	0.52	0.83	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.08	477.7	522.49	503.28	407.87	277.15	186.22	194.92	298.71	405.05	402.51	388.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	734.99	715.33	651.3	541.91	414.44	277.72	186.27	195.02	301.65	460.04	607.39	729.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 972.47 (98)

Space heating requirement in kWh/m²/year 19.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	241.73	159.69	95.84	27.81	4.89	0	0	0	0	40.91	147.51	254.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	258.54	170.79	102.5	29.75	5.23	0	0	0	0	43.75	157.77	271.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1040.08 (211)

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Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	168.37	148.58	156.48	140.87	138.49	124.37	120.04	130.9	130.41	146.05	153.67	164.52

Efficiency of water heater 79.8 (216)

(217)m=	85.78	85.01	83.55	81.39	80.12	79.8	79.8	79.8	79.8	81.92	84.7	85.97

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.28	174.79	187.28	173.09	172.84	155.85	150.42	164.03	163.42	178.28	181.42	191.37

Total = Sum(219a)$_{1...12}$ = 2089.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1040.08	
Water heating fuel used		2089.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		234.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3438.41	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	224.66	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	451.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =				675.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.58	(268)
Total CO2, kg/year		sum of (265)…(271) =			836.4	(272)

TER = 23.88 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 11

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	180.34	**(P1)**
Transmission heat loss coefficient:	21	
Summer heat loss coefficient:	201.36	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
West (W)	0.9 x	15.14	108.47	0.4	0.8	0.9	425.66	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.55	106.3	0.4	0.7	0.9	61.48	
						Total	541.21	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	326.38	313.72	319.98	
Total summer gains	909.49	854.93	790.07	**(P5)**
Summer gain/loss ratio	4.52	4.25	3.92	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.52	21.95	21.52	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:32

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 37.96m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 25 Flat 25 12
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	29.21 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.40 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	36.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.81 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.06 kWh/day
Permitted by DBSCG: 1.83 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.62	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	15.83m²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

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SAP Input

Property Details: Level 25 Flat 25 12

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	37.96 m²	2.7 m

Living area:	18.71 m² (fraction 0.492)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	15.83	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	21.12	15.83	5.29	0.24	0	True	N/A
Internal Elements							
INT WALL	47.52						N/A
Party Elements							
PARTY WALLS	38.15						N/A
WALLS TO CORRIDOR	14.22						N/A
PARTY CEILING	37.96						N/A
PARTY FLOOR	37.96						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1095

	Length	**Psi-value**		
[Approved]	17.88	0.05	E4	Jamb
[Approved]	15.64	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.4	0.06	E18	Party wall between dwellings

SAP Input

	38.79	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P350 YNW-A EER: 3.98 Compressor control: Systems with variable speed compressors Cooled area: 32.38 (fraction 0.853)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 143 litres Cylinder insulation: Measured loss, 1.06kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None

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SAP Input

Assess Zero Carbon Home: No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			15.83	x 1/[1/(1)+ 0.04]		=	15.22			(27)
Walls	21.12	15.83	5.29	x	0.24	=	1.27			(29)
Total area of elements, m²			21.12							(31)
Party wall			38.15	x	0	=	0			(32)
Party wall			14.22	x	0	=	0			(32)
Party floor			37.96							(32a)
Party ceiling			37.96							(32b)
Internal wall **			47.52							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 18.8 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.33	12.17	12	11.18	11.02	10.2	10.2	10.04	10.53	11.02	11.35	11.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	31.13	30.97	30.81	29.99	29.82	29	29	28.84	29.33	29.82	30.15	30.48	

Average = Sum(39)$_{1...12}$ /12= 29.95 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.79	0.79	0.76	0.76	0.76	0.77	0.79	0.79	0.8

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 143 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.06 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.64 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.64 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	19.72	17.81	19.72	19.08	19.72	19.08	19.72	19.72	19.08	19.72	19.08	19.72

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52	

Output from water heater (annual)$_{1...12}$ 1275.92 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.76	45.72	48.25	43.58	42.94	38.71	37.5	40.7	40.49	45.17	47.35	50.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	81.19	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.95	23.05	18.75	14.19	10.61	8.96	9.68	12.58	16.88	21.44	25.02	26.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	173.79	175.59	171.05	161.37	149.16	137.68	130.02	128.21	132.76	142.43	154.64	166.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	44.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	69.56	68.03	64.85	60.52	57.71	53.76	50.4	54.7	56.23	60.71	65.77	68.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.84	338.21	326.18	307.63	289.02	271.94	261.63	267.03	277.41	296.12	316.97	332.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	15.83	x	11.28	x	0.4	x	0.8	=	39.61	(81)
Northwest 0.9x	0.77	x	15.83	x	22.97	x	0.4	x	0.8	=	80.62	(81)
Northwest 0.9x	0.77	x	15.83	x	41.38	x	0.4	x	0.8	=	145.26	(81)
Northwest 0.9x	0.77	x	15.83	x	67.96	x	0.4	x	0.8	=	238.56	(81)
Northwest 0.9x	0.77	x	15.83	x	91.35	x	0.4	x	0.8	=	320.67	(81)

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Northwest	0.9x	0.77	x	15.83	x	97.38	x	0.4	x	0.8	=	341.86		(81)
Northwest	0.9x	0.77	x	15.83	x	91.1	x	0.4	x	0.8	=	319.81		(81)
Northwest	0.9x	0.77	x	15.83	x	72.63	x	0.4	x	0.8	=	254.95		(81)
Northwest	0.9x	0.77	x	15.83	x	50.42	x	0.4	x	0.8	=	177		(81)
Northwest	0.9x	0.77	x	15.83	x	28.07	x	0.4	x	0.8	=	98.53		(81)
Northwest	0.9x	0.77	x	15.83	x	14.2	x	0.4	x	0.8	=	49.84		(81)
Northwest	0.9x	0.77	x	15.83	x	9.21	x	0.4	x	0.8	=	32.35		(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	39.61	80.62	145.26	238.56	320.67	341.86	319.81	254.95	177	98.53	49.84	32.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	380.45	418.84	471.44	546.18	609.69	613.8	581.43	521.99	454.41	394.65	366.81	364.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.87	0.83	0.75	0.6	0.44	0.3	0.22	0.25	0.43	0.67	0.82	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.19	20.49	20.8	20.94	20.99	21	21	20.96	20.75	20.36	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.28	20.28	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.81	0.72	0.57	0.41	0.27	0.18	0.21	0.39	0.64	0.8	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.19	19.6	20.02	20.2	20.27	20.28	20.28	20.24	19.98	19.44	18.89	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.68	20.04	20.41	20.57	20.63	20.63	20.63	20.59	20.36	19.89	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.8	0.72	0.57	0.42	0.28	0.2	0.23	0.41	0.64	0.79	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	319.45	334.49	338.29	313.36	255.08	173.07	116.63	121.5	184.57	253.67	289.08	310.18	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	471.4	457.77	417.12	345.01	264.39	174.77	117.02	122.13	190.47	291.11	385.74	464.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	496.16	(98)
Space heating requirement in kWh/m²/year	13.07	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	272.63	214.62	219.18	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	265.09	211.14	213.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	671.52	635.43	565.03	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	292.63	315.67	261.22	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	869.52	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	62.4	67.32	55.71	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	185.43	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.88	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.37	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	113.05	82.84	58.65	22.78	6.92	0	0	0	0	27.86	69.6	114.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	66.5	48.73	34.5	13.4	4.07	0	0	0	0	16.39	40.94	67.33	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	291.86	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	127.93	112.46	117.38	104.23	101.42	89.58	85.05	94.68	94.94	108.13	115.59	124.52

Total = Sum(219a)$_{1...12}$ = 1275.92 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	11.61	12.53	10.37	0	0	0	0

Total = Sum(221)$_{6...8}$ = 34.51 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		291.86	
Water heating fuel used		1275.92	
Space cooling fuel used		34.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	108.53		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	108.53	(231)
Electricity for lighting		183.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		1894.14	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	38.5	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	168.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	4.55	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.32	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	24.18	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				249.84	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.26	(257)
SAP rating (Section 12)		82.36	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	151.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	662.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =				813.67	(265)
Space cooling	(221) x		0.519	=	17.91	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	56.33	(267)
Electricity for lighting	(232) x		0.519	=	95.15	(268)
Total CO2, kg/year		sum of (265)…(271) =			983.06	(272)
CO2 emissions per m²		(272) ÷ (4) =			25.9	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	896	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	3917.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4813.06	(265)
Space cooling	(221) x		3.07	=	105.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	333.2	(267)
Electricity for lighting	(232) x		0	=	562.81	(268)
‘Total Primary Energy		sum of (265)…(271) =			5815.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			153.19	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 25 Flat 25 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.96	(1a) x	2.7	(2a) =	102.49	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		102.49	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			9.49	x 1/[1/(1.5)+ 0.04] =	13.43			(27)
Walls	21.12	9.49	11.63	x 0.18 =	2.09			(29)
Total area of elements, m²			21.12					(31)
Party wall			38.15	x 0 =	0			(32)
Party wall			14.22	x 0 =	0			(32)
Party floor			37.96					(32a)
Party ceiling			37.96					(32b)
Internal wall **			47.52					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 15.52 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3464.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.31 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.18	20.06	19.93	19.35	19.24	18.73	18.73	18.63	18.92	19.24	19.46	19.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.02	37.89	37.77	37.18	37.07	36.56	36.56	36.47	36.76	37.07	37.29	37.53	

Average = Sum(39)$_{1...12}$ /12= 37.18 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1	1	0.99	0.98	0.98	0.96	0.96	0.96	0.97	0.98	0.98	0.99

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.35 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 66.34 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	72.97	70.32	67.67	65.01	62.36	59.71	59.71	62.36	65.01	67.67	70.32	72.97

Total = Sum(44)$_{1...12}$ = 796.07 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.22	94.65	97.67	85.15	81.7	70.5	65.33	74.97	75.86	88.41	96.51	104.8

Total = Sum(45)$_{1...12}$ = 1043.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.23	14.2	14.65	12.77	12.26	10.58	9.8	11.25	11.38	13.26	14.48	15.72

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.36 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.73 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.73 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	22.69	20.49	22.69	21.96	22.69	21.96	22.69	22.69	21.96	22.69	21.96	22.69

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76	

Output from water heater (annual)$_{1...12}$ 1584.83 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	72.74	64.67	69.24	63.89	63.93	59.02	58.48	61.69	60.8	66.16	67.67	71.61	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	67.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.38	9.22	7.5	5.68	4.24	3.58	3.87	5.03	6.75	8.57	10.01	10.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.44	117.65	114.6	108.12	99.94	92.25	87.11	85.9	88.95	95.43	103.61	111.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	29.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	-54.13	(71)

Water heating gains (Table 5)

(72)m=	97.77	96.24	93.06	88.73	85.92	81.97	78.61	82.92	84.45	88.92	93.98	96.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	270.89	269.41	261.46	248.83	236.4	224.1	215.89	220.15	226.44	239.23	253.9	264.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	9.49	x	11.28	x	0.63	x	0.7	=	32.72	(81)
Northwest 0.9x	0.77	x	9.49	x	22.97	x	0.63	x	0.7	=	66.61	(81)
Northwest 0.9x	0.77	x	9.49	x	41.38	x	0.63	x	0.7	=	120.01	(81)
Northwest 0.9x	0.77	x	9.49	x	67.96	x	0.63	x	0.7	=	197.09	(81)
Northwest 0.9x	0.77	x	9.49	x	91.35	x	0.63	x	0.7	=	264.93	(81)

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Northwest	0.9x	0.77	x	9.49	x	97.38	x	0.63	x	0.7	=	282.44	(81)
Northwest	0.9x	0.77	x	9.49	x	91.1	x	0.63	x	0.7	=	264.22	(81)
Northwest	0.9x	0.77	x	9.49	x	72.63	x	0.63	x	0.7	=	210.64	(81)
Northwest	0.9x	0.77	x	9.49	x	50.42	x	0.63	x	0.7	=	146.23	(81)
Northwest	0.9x	0.77	x	9.49	x	28.07	x	0.63	x	0.7	=	81.4	(81)
Northwest	0.9x	0.77	x	9.49	x	14.2	x	0.63	x	0.7	=	41.17	(81)
Northwest	0.9x	0.77	x	9.49	x	9.21	x	0.63	x	0.7	=	26.72	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	32.72	66.61	120.01	197.09	264.93	282.44	264.22	210.64	146.23	81.4	41.17	26.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	303.62	336.02	381.47	445.92	501.33	506.54	480.11	430.78	372.68	320.63	295.07	291.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.86	0.66	0.46	0.33	0.39	0.66	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.15	20.29	20.54	20.82	20.97	21	21	21	20.98	20.77	20.42	20.13	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.09	20.1	20.1	20.11	20.11	20.12	20.11	20.1	20.1	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.31	0.58	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.17	19.52	19.91	20.07	20.11	20.11	20.12	20.09	19.85	19.36	18.94	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.55	19.72	20.02	20.36	20.51	20.55	20.55	20.55	20.53	20.3	19.88	19.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.63	0.43	0.3	0.35	0.62	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	299.76	328.3	359.79	370.73	316.39	216.55	144.35	151.16	229.79	287.25	287.51	288.2	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	579.79	561.55	510.57	426.17	326.71	217.47	144.44	151.38	236.29	359.69	476.7	575.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	928.51	(98)
Space heating requirement in kWh/m²/year	24.46	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	208.34	156.75	112.18	39.92	7.68	0	0	0	0	53.89	136.22	213.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	222.83	167.64	119.98	42.69	8.21	0	0	0	0	57.64	145.69	228.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 993.06 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.17	136.15	143.62	129.62	127.66	114.97	111.28	120.92	120.33	134.36	140.98	150.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	85.62	85.19	84.16	82.09	80.34	79.8	79.8	79.8	79.8	82.6	84.72	85.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.07	159.82	170.64	157.91	158.9	144.08	139.45	151.53	150.79	162.68	166.4	175.82

Total = Sum(219a)$_{1...12}$ = 1918.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		993.06
Water heating fuel used		1918.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		183.33 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3169.48 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	214.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			628.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	95.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			762.88	(272)

TER = 29.21 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 25 Flat 25 12

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	135.29	**(P1)**
Transmission heat loss coefficient:	18.8	
Summer heat loss coefficient:	154.09	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	15.83	89.66	0.4	0.8	0.9	367.87	
						Total	367.87	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	271.94	261.63	267.03	
Total summer gains	677.51	629.49	555.54	**(P5)**
Summer gain/loss ratio	4.4	4.09	3.61	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.4	21.79	21.21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:50

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 26 Flat 26 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26 Flat 26 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26 Flat 26 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:42

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels
Plot Reference: Level 26 Flat 26 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26 Flat 26 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26 Flat 26 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:24

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels
Plot Reference: Level 26 Flat 26 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26 Flat 26 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26 Flat 26 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:17

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels
Plot Reference: Level 26 Flat 26 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26 Flat 26 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26 Flat 26 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:09

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 26 Flat 26 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26 Flat 26 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26 Flat 26 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:00

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels
Plot Reference: Level 26 Flat 26 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26 Flat 26 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26 Flat 26 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:32:51

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.45m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 26 Flat 26 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26 Flat 26 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26 Flat 26 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26 Flat 26 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:33:34

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels
Plot Reference: Level 26Flat 26 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 26Flat 26 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26Flat 26 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 26Flat 26 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 26Flat 26 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:26

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels
Plot Reference: Level 27 Flat 27 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:17

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 90.94m²

Site Reference : P1785 St Michaels

Plot Reference: Level 27 Flat 27 02

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:09

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.81m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 27 Flat 27 03

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:21:01

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.72m²

Site Reference : P1785 St Michaels

Plot Reference: Level 27 Flat 27 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:54

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 27 Flat 27 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:47

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels
Plot Reference: Level 27 Flat 27 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:42

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels
Plot Reference: Level 27 Flat 27 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:36

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.45m²
Site Reference : P1785 St Michaels
Plot Reference: Level 27 Flat 27 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 27 Flat 27 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 27 Flat 27 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 27 Flat 27 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:30

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 28 Flat 28 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

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Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:25

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 28 Flat 28 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:20

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.81m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 28 Flat 28 03

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:14

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels
Plot Reference: Level 28 Flat 28 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:09

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels
Plot Reference: Level 28 Flat 28 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.21 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:20:04

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels
Plot Reference: Level 28 Flat 28 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:59

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.75m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 28 Flat 28 07

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:54

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.45m²

Site Reference : P1785 St Michaels

Plot Reference: Level 28 Flat 28 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 28 Flat 28 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 28 Flat 28 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 28 Flat 28 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:49

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels
Plot Reference: Level 29 Flat 29 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:44

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 90.94m²

Site Reference : P1785 St Michaels

Plot Reference: Level 29 Flat 29 02

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:39

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 29 Flat 29 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:27

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels
Plot Reference: Level 29 Flat 29 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:22

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.5m²

Site Reference : P1785 St Michaels

Plot Reference: Level 29 Flat 29 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:17

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 29 Flat 29 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:12

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels
Plot Reference: Level 29 Flat 29 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:07

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.45m²
Site Reference : P1785 St Michaels
Plot Reference: Level 29 Flat 29 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 29 Flat 29 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 29 Flat 29 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 29 Flat 29 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:19:02

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 30 Flat 30 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:57

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 30 Flat 30 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:52

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 30 Flat 30 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:47

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels
Plot Reference: Level 30 Flat 30 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:42

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels
Plot Reference: Level 30 Flat 30 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:36

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels
Plot Reference: Level 30 Flat 30 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:31

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 30 Flat 30 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:25

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.45m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 30 Flat 30 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 30 Flat 30 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 30 Flat 30 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 30 Flat 30 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:19

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 31 Flat 31 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:14

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 31 Flat 31 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:09

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels
Plot Reference: Level 31 Flat 31 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:18:04

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels
Plot Reference: Level 31 Flat 31 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:59

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels
Plot Reference: Level 31 Flat 31 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:53

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.42m²

Site Reference : P1785 St Michaels

Plot Reference: Level 31 Flat 31 06

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:48

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 31 Flat 31 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:42

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.45m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 31 Flat 31 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 31 Flat 31 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 31 Flat 31 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 31 Flat 31 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:36

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels
Plot Reference: Level 32 Flat 32 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:30

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels
Plot Reference: Level 32 Flat 32 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:24

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels
Plot Reference: Level 32 Flat 32 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:18

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 32 Flat 32 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:13

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 32 Flat 32 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:07

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels
Plot Reference: Level 32 Flat 32 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

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Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:17:02

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 32 Flat 32 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:56

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.45m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 32 Flat 32 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 32 Flat 32 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 32 Flat 32 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 32 Flat 32 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:10

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.45m²

Site Reference : P1785 St Michaels

Plot Reference: Level 33 Flat 32 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 32 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 32 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 32 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 32 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:50

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 33 Flat 33 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 33 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 33 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:44

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 33 Flat 33 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 33 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 33 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:38

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 33 Flat 33 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 33 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 33 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:33

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.72m²

Site Reference : P1785 St Michaels

Plot Reference: Level 33 Flat 33 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 33 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 33 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:27

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 33 Flat 33 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 33 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 33 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:21

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.42m²

Site Reference : P1785 St Michaels

Plot Reference: Level 33 Flat 33 06

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 33 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 33 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:16

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 33 Flat 33 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 33 Flat 33 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 33 Flat 33 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 33 Flat 33 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:05

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 34 Flat 34 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:16:00

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 34 Flat 34 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:55

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels
Plot Reference: Level 34 Flat 34 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:50

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 34 Flat 34 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:44

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.5m²
Site Reference : P1785 St Michaels
Plot Reference: Level 34 Flat 34 05
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.31 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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TER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:39

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels
Plot Reference: Level 34 Flat 34 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:34

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.75m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 34 Flat 34 07
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:29

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.45m²
Site Reference : P1785 St Michaels
Plot Reference: Level 34 Flat 34 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 34 Flat 34 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 34 Flat 34 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 34 Flat 34 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:24

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 91.31m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 35 Flat 35 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:18

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 90.94m²
Site Reference : P1785 St Michaels
Plot Reference: Level 35 Flat 35 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

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PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:13

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.81m²
Site Reference : P1785 St Michaels
Plot Reference: Level 35 Flat 35 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

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2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:08

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.72m²
Site Reference : P1785 St Michaels
Plot Reference: Level 35 Flat 35 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:15:02

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.5m²

Site Reference : P1785 St Michaels

Plot Reference: Level 35 Flat 35 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5 (1a)	x	2.7 (2a)	=	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:57

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.42m²

Site Reference : P1785 St Michaels

Plot Reference: Level 35 Flat 35 06

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:52

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.75m²

Site Reference : P1785 St Michaels

Plot Reference: Level 35 Flat 35 07

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:46

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 80.45m²
Site Reference : P1785 St Michaels
Plot Reference: Level 35 Flat 35 08
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 35 Flat 35 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 35 Flat 35 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 35 Flat 35 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:41

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 91.31m²

Site Reference : P1785 St Michaels

Plot Reference: Level 36 Flat 36 01

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.68 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m²
Windows facing: West	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	91.31 m²	2.7 m

Living area:	43.22 m² (fraction 0.473)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.78						N/A
WALLS TO CORRIDOR	15.36						N/A
PARTY CEILING	91.31						N/A

SAP Input

PARTY FLOOR	91.31	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.15	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 74.27 (fraction 0.813)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.78	x	0	=	0			(32)
Party wall			15.36	x	0	=	0			(32)
Party floor			91.31							(32a)
Party ceiling			91.31							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	

Average = Sum(39)$_{1...12}$ /12= 75.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Output from water heater (annual)$_{1...12}$ — 1878.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1594.5	(98)
Space heating requirement in kWh/m²/year	17.46	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	686.45	540.4	551.72	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	663.06	529.28	534.48	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1623.69	1534.83	1341.41	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	691.66	748.13	600.35	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2040.14	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.65	152.13	122.08	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.85	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.54	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	937.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15	

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 188.14 | 165.41 | 172.72 | 153.45 | 149.38 | 132.04 | 125.45 | 139.54 | 139.88 | 159.19 | 170.06 | 183.15 |

Total = Sum(219a)$_{1...12}$ = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 25.1 | 27.15 | 21.79 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 74.05 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.94	
Water heating fuel used		1878.41	
Space cooling fuel used		74.05	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	297.02		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.02	(231)
Electricity for lighting		380.17	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3567.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.77	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	50.14	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		470.57	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.77	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.79	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1461.69	(265)
Space cooling	(221)	x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	154.15	(267)
Electricity for lighting	(232)	x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)…(271) =			1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.28	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2879.48	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8646.2	(265)
Space cooling	(221)	x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	911.84	(267)
Electricity for lighting	(232)	x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)…(271) =			10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			119.95	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	91.31	(1a) x	2.7	(2a) =	246.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		246.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.57	x1/[1/(1.5)+ 0.04]	=	16.37			(27)
Windows Type 2			3.69	x1/[1/(1.5)+ 0.04]	=	5.22			(27)
Windows Type 3			6.25	x1/[1/(1.5)+ 0.04]	=	8.84			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04]	=	1.87			(27)
Walls	50.44	22.83	27.61	x 0.18	=	4.97			(29)
Total area of elements, m²			50.44						(31)
Party wall			53.78	x 0	=	0			(32)
Party wall			15.36	x 0	=	0			(32)
Party floor			91.31						(32a)
Party ceiling			91.31						(32b)
Internal wall **			163.24						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19674.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.28	47.02	46.77	45.59	45.37	44.34	44.34	44.15	44.74	45.37	45.82	46.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.41	88.15	87.9	86.72	86.5	85.47	85.47	85.28	85.87	86.5	86.95	87.41	

Average = Sum(39)$_{1...12}$ /12= 86.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	

Total = Sum(44)$_{1...12}$ = 1163.72 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	

Total = Sum(45)$_{1...12}$ = 1525.82 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3	

Output from water heater (annual)$_{1...12}$ — 2115.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.67	82.2	87.55	80.17	79.79	73.05	71.83	76.51	75.66	83.05	85.69	91.01	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	(71)

Water heating gains (Table 5)

(72)m=	124.56	122.32	117.67	111.34	107.24	101.46	96.54	102.84	105.08	111.62	119.01	122.33	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	453.2	451.06	436.53	412.98	388.93	365.84	350.87	357.06	369.18	392.95	420.28	440.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.25	x	10.63	x	0.63	x	0.7	=	20.31	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.25	x	20.32	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.25	x	34.53	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.25	x	55.46	x	0.63	x	0.7	=	105.94	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.25	x	74.72	x	0.63	x	0.7	=	142.71	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.25	x	79.99	x	0.63	x	0.7	=	152.78	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.25	x	74.68	x	0.63	x	0.7	=	142.64	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.25	x	59.25	x	0.63	x	0.7	=	113.17	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.25	x	41.52	x	0.63	x	0.7	=	79.3	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.25	x	24.19	x	0.63	x	0.7	=	46.2	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.25	x	13.12	x	0.63	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.25	x	8.86	x	0.63	x	0.7	=	16.93	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
West	0.9x	0.77	x	3.69	x	19.64	x	0.63	x	0.7	=	22.15	(80)
West	0.9x	0.77	x	3.69	x	38.42	x	0.63	x	0.7	=	43.33	(80)
West	0.9x	0.77	x	3.69	x	63.27	x	0.63	x	0.7	=	71.35	(80)
West	0.9x	0.77	x	3.69	x	92.28	x	0.63	x	0.7	=	104.07	(80)
West	0.9x	0.77	x	3.69	x	113.09	x	0.63	x	0.7	=	127.54	(80)
West	0.9x	0.77	x	3.69	x	115.77	x	0.63	x	0.7	=	130.56	(80)
West	0.9x	0.77	x	3.69	x	110.22	x	0.63	x	0.7	=	124.29	(80)
West	0.9x	0.77	x	3.69	x	94.68	x	0.63	x	0.7	=	106.77	(80)
West	0.9x	0.77	x	3.69	x	73.59	x	0.63	x	0.7	=	82.99	(80)
West	0.9x	0.77	x	3.69	x	45.59	x	0.63	x	0.7	=	51.41	(80)
West	0.9x	0.77	x	3.69	x	24.49	x	0.63	x	0.7	=	27.62	(80)
West	0.9x	0.77	x	3.69	x	16.15	x	0.63	x	0.7	=	18.21	(80)
Northwest	0.9x	0.77	x	11.57	x	11.28	x	0.63	x	0.7	=	39.9	(81)
Northwest	0.9x	0.77	x	11.57	x	22.97	x	0.63	x	0.7	=	81.21	(81)
Northwest	0.9x	0.77	x	11.57	x	41.38	x	0.63	x	0.7	=	146.31	(81)
Northwest	0.9x	0.77	x	11.57	x	67.96	x	0.63	x	0.7	=	240.29	(81)
Northwest	0.9x	0.77	x	11.57	x	91.35	x	0.63	x	0.7	=	322.99	(81)

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Northwest	0.9x	0.77	x	11.57	x	97.38	x	0.63	x	0.7	=	344.35	(81)
Northwest	0.9x	0.77	x	11.57	x	91.1	x	0.63	x	0.7	=	322.13	(81)
Northwest	0.9x	0.77	x	11.57	x	72.63	x	0.63	x	0.7	=	256.8	(81)
Northwest	0.9x	0.77	x	11.57	x	50.42	x	0.63	x	0.7	=	178.28	(81)
Northwest	0.9x	0.77	x	11.57	x	28.07	x	0.63	x	0.7	=	99.24	(81)
Northwest	0.9x	0.77	x	11.57	x	14.2	x	0.63	x	0.7	=	50.2	(81)
Northwest	0.9x	0.77	x	11.57	x	9.21	x	0.63	x	0.7	=	32.58	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.64	171.55	297.55	472.67	623.38	659.95	619.19	500.64	357.32	206.62	108.16	71.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	539.85	622.61	734.08	885.65	1012.32	1025.78	970.05	857.7	726.5	599.57	528.45	512.22	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.46	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.54	19.86	20.27	20.49	20.54	20.54	20.54	20.5	20.17	19.69	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.72	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.1	617.86	715.36	793.66	719.32	503.77	336.76	352.42	519.8	571.81	524.6	510.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1330.89	1290.24	1174.39	985.83	760	507.72	337.17	353.48	549.84	827.85	1094.99	1322.5	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2756.77	(98)
Space heating requirement in kWh/m²/year	30.19	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	589.84	451.84	341.52	138.36	30.27	0	0	0	0	190.49	410.68	603.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	630.84	483.25	365.26	147.98	32.37	0	0	0	0	203.74	439.23	645.74	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2948.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
208.29	183.6	192.87	172.95	169.53	151.54	145.6	159.68	159.38	179.34	189.56	203.3

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.44	87.12	86.32	84.23	81.26	79.8	79.8	79.8	79.8	84.97	86.82	87.54

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	238.2	210.74	223.42	205.34	208.63	189.9	182.45	200.1	199.72	211.05	218.32	232.22

Total = Sum(219a)$_{1...12}$ = 2520.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2948.42
Water heating fuel used		2520.1
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		380.17 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5923.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	636.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	544.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1181.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year	sum of (265)…(271) =			1417.43	(272)

TER = 22.64 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	325.43	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	371.78	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	490.26	470.94	479.51	
Total summer gains	1640.7	1517.94	1313.96	**(P5)**
Summer gain/loss ratio	4.41	4.08	3.53	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.41	21.78	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:36

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 90.94m²

Site Reference : P1785 St Michaels

Plot Reference: Level 36 Flat 36 02

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.67 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.73 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	38.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m²
Windows facing: East	6.79m²
Windows facing: North	11.49m²
Windows facing: North	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	90.94 m²	2.7 m

Living area:	42.61 m² (fraction 0.469)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.27	1
E	16mm or more	1	0.4	1	6.79	1
N	16mm or more	1	0.4	1	11.49	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.44	41.98	8.46	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	163.24						N/A
Party Elements							
PARTY WALLS	53.45						N/A
WALLS TO CORRIDOR	15.57						N/A
PARTY CEILING	90.94						N/A

SAP Input

PARTY FLOOR 90.94 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0785

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.17	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.2	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	51.12	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 73.83 (fraction 0.812)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.49	x 1/[1/(1)+ 0.04]		=	11.05			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.44	41.98	8.46	x	0.24	=	2.03			(29)
Total area of elements, m²			50.44							(31)
Party wall			53.45	x	0	=	0			(32)
Party wall			15.57	x	0	=	0			(32)
Party floor			90.94							(32a)
Party ceiling			90.94							(32b)
Internal wall **			163.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.35 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79	

Average = Sum(39)$_{1...12}$ /12= 75.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97	

Output from water heater (annual)$_{1...12}$ — 1876.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9		(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45		(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2		(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51		(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81		(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09		(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4		(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1590.91	(98)
Space heating requirement in kWh/m²/year	17.49	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	685.45	539.61	550.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	662.02	528.46	533.65	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1622.66	1533.84	1340.41	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	691.66	748	600.23	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2039.9	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.81	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	140.38	151.82	121.83	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	414.02	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.55	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	935.83	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 187.95 165.24 172.55 153.31 149.24 131.92 125.34 139.41 139.75 159.04 169.89 182.97

Total = Sum(219a)$_{1...12}$ = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= 0 0 0 0 0 25.06 27.1 21.74 0 0 0 0

Total = Sum(221)$_{6...8}$ = 73.9 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		935.83
Water heating fuel used		1876.6
Space cooling fuel used		73.9
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	295.81	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		295.81 (231)
Electricity for lighting		379.12 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3561.25 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.45	(257)
SAP rating (Section 12)		79.75	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	485.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1459.65	(265)
Space cooling	(221) x		0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	153.53	(267)
Electricity for lighting	(232) x		0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)…(271) =			1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =			20.32	(273)
EI rating (section 14)					82	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2873	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8634.15	(265)
Space cooling	(221) x		3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	908.14	(267)
Electricity for lighting	(232) x		0	=	1163.89	(268)
'Total Primary Energy		sum of (265)…(271) =			10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			120.22	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	90.94	(1a) x	2.7	(2a) =	245.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			11.52	x1/[1/(1.5)+ 0.04] =	16.3			(27)
Windows Type 2			3.68	x1/[1/(1.5)+ 0.04] =	5.21			(27)
Windows Type 3			6.22	x1/[1/(1.5)+ 0.04] =	8.8			(27)
Windows Type 4			1.32	x1/[1/(1.5)+ 0.04] =	1.87			(27)
Walls	50.44	22.74	27.7	x 0.18 =	4.99			(29)
Total area of elements, m²			50.44					(31)
Party wall			53.45	x 0 =	0			(32)
Party wall			15.57	x 0 =	0			(32)
Party floor			90.94					(32a)
Party ceiling			90.94					(32b)
Internal wall **			163.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 19606.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.02 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.11	46.85	46.6	45.42	45.2	44.17	44.17	43.98	44.57	45.2	45.65	46.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.12	87.87	87.62	86.44	86.22	85.19	85.19	85	85.59	86.22	86.66	87.13	

Average = Sum(39)$_{1...12}$ /12= 86.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.64 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55	

Total = Sum(44)$_{1...12}$ = 1162.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02	

Total = Sum(45)$_{1...12}$ = 1524.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	

Output from water heater (annual)$_{1...12}$ — 2113.8 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.61	82.14	87.49	80.12	79.74	73.01	71.79	76.47	75.61	83	85.63	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	(71)

Water heating gains (Table 5)

(72)m=	124.48	122.24	117.59	111.28	107.18	101.4	96.49	102.78	105.02	111.55	118.94	122.25	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	452.32	450.18	435.67	412.18	388.2	365.15	350.22	356.41	368.5	392.21	419.48	440.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	6.22	x	10.63	x	0.63	x	0.7	=	20.21	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	6.22	x	20.32	x	0.63	x	0.7	=	38.63	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	6.22	x	34.53	x	0.63	x	0.7	=	65.64	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	6.22	x	55.46	x	0.63	x	0.7	=	105.43	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	6.22	x	74.72	x	0.63	x	0.7	=	142.03	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	6.22	x	79.99	x	0.63	x	0.7	=	152.05	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	6.22	x	74.68	x	0.63	x	0.7	=	141.95	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	6.22	x	59.25	x	0.63	x	0.7	=	112.62	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)
North	0.9x	0.77	x	6.22	x	41.52	x	0.63	x	0.7	=	78.92	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	6.22	x	24.19	x	0.63	x	0.7	=	45.98	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	6.22	x	13.12	x	0.63	x	0.7	=	24.94	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	6.22	x	8.86	x	0.63	x	0.7	=	16.85	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
Northeast	0.9x	0.77	x	11.52	x	11.28	x	0.63	x	0.7	=	39.72	(75)
Northeast	0.9x	0.77	x	11.52	x	22.97	x	0.63	x	0.7	=	80.86	(75)
Northeast	0.9x	0.77	x	11.52	x	41.38	x	0.63	x	0.7	=	145.68	(75)
Northeast	0.9x	0.77	x	11.52	x	67.96	x	0.63	x	0.7	=	239.25	(75)
Northeast	0.9x	0.77	x	11.52	x	91.35	x	0.63	x	0.7	=	321.6	(75)
Northeast	0.9x	0.77	x	11.52	x	97.38	x	0.63	x	0.7	=	342.86	(75)
Northeast	0.9x	0.77	x	11.52	x	91.1	x	0.63	x	0.7	=	320.74	(75)
Northeast	0.9x	0.77	x	11.52	x	72.63	x	0.63	x	0.7	=	255.69	(75)
Northeast	0.9x	0.77	x	11.52	x	50.42	x	0.63	x	0.7	=	177.51	(75)
Northeast	0.9x	0.77	x	11.52	x	28.07	x	0.63	x	0.7	=	98.82	(75)
Northeast	0.9x	0.77	x	11.52	x	14.2	x	0.63	x	0.7	=	49.98	(75)
Northeast	0.9x	0.77	x	11.52	x	9.21	x	0.63	x	0.7	=	32.44	(75)
East	0.9x	0.77	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	0.77	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	0.77	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	0.77	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	0.77	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)

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TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	0.77	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	0.77	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	0.77	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	0.77	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	0.77	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	0.77	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.31	170.89	296.41	470.84	620.96	657.37	616.77	498.7	355.94	205.83	107.75	71.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.63	621.07	732.08	883.03	1009.16	1022.53	966.99	855.1	724.44	598.04	527.23	511.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.98	0.92	0.74	0.53	0.39	0.45	0.76	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.15	20.41	20.75	20.94	20.99	21	21	20.95	20.66	20.27	19.98	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.89	0.69	0.46	0.31	0.37	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.37	19.84	20.08	20.13	20.14	20.14	20.1	19.73	19.17	18.74	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.35	19.53	19.86	20.26	20.48	20.54	20.54	20.54	20.5	20.17	19.69	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.71	0.49	0.35	0.41	0.71	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	536.87	616.29	713.3	791.02	716.66	501.75	335.28	350.89	517.85	570.18	523.35	509.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1326.06	1285.56	1170.14	982.22	757.13	505.68	335.69	351.95	547.67	824.77	1090.97	1317.67	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2743.7	(98)
Space heating requirement in kWh/m²/year	30.17	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
587.16	449.75	339.89	137.66	30.11	0	0	0	0	189.41	408.68	601.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
627.98	481.02	363.52	147.23	32.21	0	0	0	0	202.58	437.09	642.81	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2934.44	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	208.1	183.44	192.7	172.8	169.38	151.42	145.48	159.55	159.24	179.18	189.39	203.11	
Efficiency of water heater												79.8	(216)
(217)m=	87.43	87.12	86.31	84.22	81.25	79.8	79.8	79.8	79.8	84.96	86.81	87.54	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.01	210.57	223.25	205.19	208.47	189.75	182.31	199.94	199.55	210.9	218.15	232.04	
Total = Sum(219a)$_{1...12}$ =												2518.13	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2934.44	
Water heating fuel used		2518.13	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		379.12	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5906.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	633.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	543.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1177.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year	sum of (265)…(271) =			1413.44	(272)

TER = 22.67 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	324.11	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	370.46	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.27	89.66	0.4	0.8	0.9	494.29	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
North (N)	0.9 x	11.49	73.49	0.4	1	0.9	273.59	
North (N GLAZED DOOR)	0.9 x	2.43	73.49	0.4	0.7	0.9	40.5	
						Total	1047.01	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	489.23	469.95	478.51	
Total summer gains	1639.66	1516.96	1312.96	**(P5)**
Summer gain/loss ratio	4.43	4.09	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.43	21.79	21.14	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:31

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.81m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 36 Flat 36 03

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.25 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.14 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.3 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.86 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.81 m²	2.7 m

Living area:	41.93 m² (fraction 0.519)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NE	16mm or more	0.8	0.4	1	21.16	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NE		OPAQUE CURT WALL	North East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.26	33.81	7.45	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.88						N/A
PARTY CEILING	80.81						N/A

SAP Input

PARTY FLOOR	80.81	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	40.41	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.68 (fraction 0.850)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.16	x 1/[1/(1)+ 0.04]		=	20.35			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.26	33.81	7.45	x	0.24	=	1.79			(29)
Total area of elements, m²			41.26							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.88	x	0	=	0			(32)
Party floor			80.81							(32a)
Party ceiling			80.81							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.65 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95	

Output from water heater (annual)$_{1...12}$ — 1816.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1070.63	(98)
Space heating requirement in kWh/m²/year	13.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.93	441.58	450.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	548.01	435.81	442.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1432.38	1361.92	1222.42	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	636.74	689.03	580.41	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1906.19	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	135.29	146.4	123.32	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	405.01	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.01	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	629.78	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95

Efficiency of water heater: 100 (216)

(217)m= | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= | 181.74 | 159.81 | 166.94 | 148.42 | 144.55 | 127.87 | 121.59 | 135.1 | 135.39 | 153.96 | 164.35 | 176.95 |

Total = Sum(219a)$_{1...12}$ = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m= | 0 | 0 | 0 | 0 | 0 | 24.15 | 26.13 | 22.01 | 0 | 0 | 0 | 0 |

Total = Sum(221)$_{6...8}$ = 72.29 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		629.78	
Water heating fuel used		1816.69	
Space cooling fuel used		72.29	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.93		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.93	(231)
Electricity for lighting		348.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3089.84	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07	(240)
Space heating - main system 2	(213) x	0 x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0	(242)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1		(243)
Low-rate fraction	1.0 – (243) =	0		(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62	(245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0	(246)
Space cooling	(221)	13.19 x 0.01 =	9.54	(248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19 x 0.01 =	45.92	(250)
Additional standing charges (Table 12)			0	(251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =		407.55	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		81.02	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	326.86	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1269.72	(265)
Space cooling	(221)	x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	115.7	(267)
Electricity for lighting	(232)	x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =				1603.63	(272)
CO2 emissions per m²	(272) ÷ (4) =				19.84	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	1933.43	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7510.66	(265)
Space cooling	(221)	x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	684.4	(267)
Electricity for lighting	(232)	x	0	=	1068.81	(268)
'Total Primary Energy	sum of (265)…(271) =				9485.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				117.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.81	(1a) x	2.7	(2a) =	218.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.19	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.64	x1/[1/(1.5)+ 0.04] =	17.89			(27)
Windows Type 2			5.09	x1/[1/(1.5)+ 0.04] =	7.2			(27)
Windows Type 3			0.94	x1/[1/(1.5)+ 0.04] =	1.33			(27)
Windows Type 4			1.53	x1/[1/(1.5)+ 0.04] =	2.17			(27)
Walls	41.26	20.2	21.06	x 0.18 =	3.79			(29)
Total area of elements, m²			41.26					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.88	x 0 =	0			(32)
Party floor			80.81					(32a)
Party ceiling			80.81					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17066.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.63 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.28	41.07	40.87	39.93	39.75	38.93	38.93	38.78	39.25	39.75	40.11	40.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.91	76.71	76.51	75.56	75.39	74.56	74.56	74.41	74.88	75.39	75.74	76.12	

Average = Sum(39)$_{1...12}$ /12= 75.56 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36	

Total = Sum(44)$_{1...12}$ = 1116.64 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01	

Total = Sum(45)$_{1...12}$ = 1464.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1	

Output from water heater (annual)$_{1...12}$ — 2053.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.55	80.34	85.63	78.49	78.18	71.66	70.54	75.04	74.16	81.31	83.79	88.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	(71)

Water heating gains (Table 5)

(72)m=	121.7	119.55	115.09	109.02	105.08	99.53	94.82	100.86	103	109.29	116.38	119.56	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.71	423.65	410.14	388.3	366.1	344.69	330.77	336.72	347.92	369.97	395.32	414.36	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	12.64	x	11.28	x	0.63	x	0.7	=	43.59	(75)
Northeast	0.9x	0.77	x	12.64	x	22.97	x	0.63	x	0.7	=	88.72	(75)
Northeast	0.9x	0.77	x	12.64	x	41.38	x	0.63	x	0.7	=	159.84	(75)
Northeast	0.9x	0.77	x	12.64	x	67.96	x	0.63	x	0.7	=	262.51	(75)
Northeast	0.9x	0.77	x	12.64	x	91.35	x	0.63	x	0.7	=	352.86	(75)
Northeast	0.9x	0.77	x	12.64	x	97.38	x	0.63	x	0.7	=	376.19	(75)
Northeast	0.9x	0.77	x	12.64	x	91.1	x	0.63	x	0.7	=	351.92	(75)
Northeast	0.9x	0.77	x	12.64	x	72.63	x	0.63	x	0.7	=	280.55	(75)
Northeast	0.9x	0.77	x	12.64	x	50.42	x	0.63	x	0.7	=	194.77	(75)
Northeast	0.9x	0.77	x	12.64	x	28.07	x	0.63	x	0.7	=	108.42	(75)
Northeast	0.9x	0.77	x	12.64	x	14.2	x	0.63	x	0.7	=	54.84	(75)
Northeast	0.9x	0.77	x	12.64	x	9.21	x	0.63	x	0.7	=	35.59	(75)
East	0.9x	0.77	x	5.09	x	19.64	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	5.09	x	38.42	x	0.63	x	0.7	=	59.77	(76)
East	0.9x	0.77	x	5.09	x	63.27	x	0.63	x	0.7	=	98.43	(76)
East	0.9x	0.77	x	5.09	x	92.28	x	0.63	x	0.7	=	143.55	(76)
East	0.9x	0.77	x	5.09	x	113.09	x	0.63	x	0.7	=	175.92	(76)
East	0.9x	0.77	x	5.09	x	115.77	x	0.63	x	0.7	=	180.09	(76)
East	0.9x	0.77	x	5.09	x	110.22	x	0.63	x	0.7	=	171.45	(76)
East	0.9x	0.77	x	5.09	x	94.68	x	0.63	x	0.7	=	147.27	(76)
East	0.9x	0.77	x	5.09	x	73.59	x	0.63	x	0.7	=	114.47	(76)
East	0.9x	0.77	x	5.09	x	45.59	x	0.63	x	0.7	=	70.92	(76)
East	0.9x	0.77	x	5.09	x	24.49	x	0.63	x	0.7	=	38.09	(76)
East	0.9x	0.77	x	5.09	x	16.15	x	0.63	x	0.7	=	25.12	(76)
South	0.9x	0.77	x	0.94	x	46.75	x	0.63	x	0.7	=	13.43	(78)
South	0.9x	0.77	x	1.53	x	46.75	x	0.63	x	0.7	=	21.86	(78)
South	0.9x	0.77	x	0.94	x	76.57	x	0.63	x	0.7	=	22	(78)
South	0.9x	0.77	x	1.53	x	76.57	x	0.63	x	0.7	=	35.8	(78)
South	0.9x	0.77	x	0.94	x	97.53	x	0.63	x	0.7	=	28.02	(78)
South	0.9x	0.77	x	1.53	x	97.53	x	0.63	x	0.7	=	45.61	(78)
South	0.9x	0.77	x	0.94	x	110.23	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	1.53	x	110.23	x	0.63	x	0.7	=	51.54	(78)
South	0.9x	0.77	x	0.94	x	114.87	x	0.63	x	0.7	=	33	(78)
South	0.9x	0.77	x	1.53	x	114.87	x	0.63	x	0.7	=	53.71	(78)
South	0.9x	0.77	x	0.94	x	110.55	x	0.63	x	0.7	=	31.76	(78)
South	0.9x	0.77	x	1.53	x	110.55	x	0.63	x	0.7	=	51.69	(78)
South	0.9x	0.77	x	0.94	x	108.01	x	0.63	x	0.7	=	31.03	(78)
South	0.9x	0.77	x	1.53	x	108.01	x	0.63	x	0.7	=	50.51	(78)
South	0.9x	0.77	x	0.94	x	104.89	x	0.63	x	0.7	=	30.13	(78)
South	0.9x	0.77	x	1.53	x	104.89	x	0.63	x	0.7	=	49.05	(78)
South	0.9x	0.77	x	0.94	x	101.89	x	0.63	x	0.7	=	29.27	(78)

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South	0.9x	0.77	x	1.53	x	101.89	x	0.63	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	0.94	x	82.59	x	0.63	x	0.7	=	23.72	(78)
South	0.9x	0.77	x	1.53	x	82.59	x	0.63	x	0.7	=	38.62	(78)
South	0.9x	0.77	x	0.94	x	55.42	x	0.63	x	0.7	=	15.92	(78)
South	0.9x	0.77	x	1.53	x	55.42	x	0.63	x	0.7	=	25.91	(78)
South	0.9x	0.77	x	0.94	x	40.4	x	0.63	x	0.7	=	11.61	(78)
South	0.9x	0.77	x	1.53	x	40.4	x	0.63	x	0.7	=	18.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	109.43	206.28	331.89	489.27	615.5	639.73	604.91	507.01	386.16	241.68	134.77	91.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	535.14	629.93	742.03	877.57	981.6	984.42	935.67	843.73	734.07	611.65	530.09	505.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.32	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.73	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	532.18	621.08	709.36	747.53	644.37	444.32	297.3	311.32	469.89	563.53	523.22	503.51	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1171.15	1137.8	1036.84	868.82	667.34	446.42	297.5	311.8	484.28	732.67	966.38	1164.1	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2107.1	(98)
Space heating requirement in kWh/m²/year	26.07	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
475.39	347.24	243.64	87.33	17.09	0	0	0	0	125.84	319.08	491.48	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
508.44	371.38	260.58	93.41	18.27	0	0	0	0	134.59	341.26	525.65	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2253.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

201.89	178.01	187.09	167.91	164.7	147.37	141.73	155.25	154.89	174.11	183.85	197.1

Efficiency of water heater 79.8 (216)

(217)m=	87.02	86.57	85.52	83.16	80.7	79.8	79.8	79.8	79.8	83.97	86.27	87.15	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232	205.63	218.77	201.91	204.09	184.67	177.61	194.55	194.1	207.36	213.1	226.15

Total = Sum(219a)$_{1...12}$ = 2459.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2253.58
Water heating fuel used		2459.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		348.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5136.65 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	486.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	531.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1018.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year	sum of (265)…(271) =			1237.73	(272)

TER = 22.25 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	288.01	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.66	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (NE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (NE)	0.9 x	21.16	89.66	0.4	0.8	0.9	491.73	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	906.94	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.25	440.35	448.47	
Total summer gains	1446.99	1347.29	1197.77	**(P5)**
Summer gain/loss ratio	4.44	4.14	3.68	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.44	21.84	21.28	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:26

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.72m²

Site Reference : P1785 St Michaels

Plot Reference: Level 36 Flat 36 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.38 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	30.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m²
Windows facing: East	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.72 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.25	1
E	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.9	7.2	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.5						N/A
WALLS TO CORRIDOR	29.89						N/A
PARTY CEILING	80.72						N/A

SAP Input

PARTY FLOOR	80.71	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.43	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.855)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.9	7.2	x	0.24	=	1.73			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.5	x	0	=	0			(32)
Party wall			29.89	x	0	=	0			(32)
Party floor			80.71							(32a)
Party ceiling			80.72							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.68 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	

Average = Sum(39)$_{1...12}$ /12= 61.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89	

Output from water heater (annual)$_{1...12}$ — 1816.06 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

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South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	844.86	(98)
Space heating requirement in kWh/m²/year	10.47	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.95	441.6	450.89	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.66	437.2	445.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1548.73	1489.38	1398.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	718.61	782.83	709.48	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											2210.92		(104)
Cooled fraction f C = cooled area ÷ (4) =											0.85		(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{5...8}$ =											0		(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	153.52	167.24	151.57	0	0	0	0	
Total = Sum(107)$_{5...8}$ =											472.34		(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =											5.85		(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=												496.97	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=												0	(215)

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Water heating

Output from water heater (calculated above)

	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89

Total = Sum(219a)$_{1...12}$ = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	27.4	29.85	27.05	0	0	0	0

Total = Sum(221)$_{6...8}$ = 84.31 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		496.97	
Water heating fuel used		1816.06	
Space cooling fuel used		84.31	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.68		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.68	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2967.88	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	65.55	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.54	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.12	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.37	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.88	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				391.46	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.76	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	257.93	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1200.47	(265)
Space cooling	(221) x		0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.57	(267)
Electricity for lighting	(232) x		0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)…(271) =			1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.08	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1525.71	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7101.02	(265)
Space cooling	(221) x		3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.64	(267)
Electricity for lighting	(232) x		0	=	1067.91	(268)
'Total Primary Energy		sum of (265)…(271) =			9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			112.88	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.72	(1a) x	2.7	(2a) =	217.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.17	20.93	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.5	x 0 =	0			(32)
Party wall			29.89	x 0 =	0			(32)
Party floor			80.71					(32a)
Party ceiling			80.72					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17048.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.57 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.24	41.03	40.83	39.89	39.71	38.89	38.89	38.74	39.21	39.71	40.07	40.44	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.8	76.6	76.4	75.46	75.28	74.46	74.46	74.31	74.77	75.28	75.64	76.01	

Average = Sum(39)$_{1...12}$ /12= 75.45 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	

Total = Sum(44)$_{1...12}$ = 1116.17 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.47 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	

Output from water heater (annual)$_{1...12}$ — 2053.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.52	80.32	85.61	78.48	78.16	71.65	70.53	75.02	74.15	81.29	83.77	88.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	(71)

Water heating gains (Table 5)

(72)m=	121.67	119.52	115.06	109	105.06	99.51	94.8	100.84	102.98	109.26	116.35	119.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.45	423.39	409.89	388.07	365.88	344.49	330.58	336.53	347.72	369.75	395.09	414.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(76)
East	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(76)
East	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(76)
East	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(76)
East	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38	(76)
East	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78	(76)
East	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7	(76)
East	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02	(76)
East	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64	(76)
East	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94	(76)
East	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)

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South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33		(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47		(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36		(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75		(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74		(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48		(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	207.68	359.16	502.59	636.29	721.34	718.92	692.03	628.81	549.28	400.26	249.82	177.01	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	633.14	782.55	912.48	1024.36	1087.22	1063.42	1022.6	965.34	896.99	770.01	644.9	591.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.32	0.35	0.57	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.43	20.68	20.89	20.98	21	21	21	20.99	20.86	20.49	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.76	0.57	0.39	0.26	0.29	0.5	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.4	19.75	20.02	20.12	20.15	20.15	20.15	20.14	19.99	19.5	19.03	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.67	19.94	20.23	20.47	20.57	20.59	20.59	20.59	20.58	20.44	20.01	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.78	0.6	0.42	0.29	0.32	0.53	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	625.43	754.74	827.93	798.98	652.91	444.57	297.06	311.25	479.03	646.36	625.2	585.97	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1180.42	1151.8	1049.14	873.33	667.44	445.96	297.19	311.48	484.66	740.93	976.81	1172.04	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1668.22	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
412.92	266.82	164.58	53.53	10.8	0	0	0	0	70.36	253.16	436.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
441.62	285.37	176.02	57.25	11.56	0	0	0	0	75.25	270.76	466.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1784.19	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.82	177.95	187.03	167.86	164.65	147.33	141.69	155.21	154.84	174.05	183.79	197.03	
Efficiency of water heater												79.8	(216)
(217)m=	86.68	85.89	84.47	82.15	80.39	79.8	79.8	79.8	79.8	82.61	85.67	86.87	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	232.83	207.18	221.4	204.34	204.82	184.62	177.56	194.49	194.04	210.69	214.54	226.8	
Total = Sum(219a)$_{1...12}$ =												2473.32	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1784.19	
Water heating fuel used		2473.32	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.85	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4680.36	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	385.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	534.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			919.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.08	(272)

TER = 20.38 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.69	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.37	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.25	112.1	0.4	0.8	0.9	617.45	
East (E)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	1032.67	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.96	440.06	448.18	
Total summer gains	1565.09	1472.73	1368.5	**(P5)**
Summer gain/loss ratio	4.81	4.53	4.21	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.81	22.23	21.81	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:21

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.5m²

Site Reference : P1785 St Michaels

Plot Reference: Level 36 Flat 36 05

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m²
Windows facing: East	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 05

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.5 m²	2.7 m

Living area:	48.74 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	21.4	1
E	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
E		OPAQUE CURT WALL	East	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.4	42.08	8.32	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	70.09						N/A
WALLS TO CORRIDOR	7.3						N/A
PARTY CEILING	99.5						N/A

SAP Input

PARTY FLOOR	99.5	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.14	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.32	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 82.99 (fraction 0.834)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.4	x 1/[1/(1)+ 0.04]		=	20.58			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.4	42.08	8.32	x	0.24	=	2			(29)
Total area of elements, m²			50.4							(31)
Party wall			70.09	x	0	=	0			(32)
Party wall			7.3	x	0	=	0			(32)
Party floor			99.5							(32a)
Party ceiling			99.5							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.41 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	

Average = Sum(39)$_{1...12}$ /12= 78.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59	

Output from water heater (annual)$_{1...12}$ — 1912.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1120.49	(98)
Space heating requirement in kWh/m²/year	11.26	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	709.5	558.55	570.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	694.16	551.93	561.83	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1892.94	1826.12	1734.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	863.12	948	872.6	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2683.72	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.83	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	179.98	197.67	181.95	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	559.6	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	659.11	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59

Total = Sum(219a)$_{1...12}$ = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	32.12	35.28	32.48	0	0	0	0

Total = Sum(221)$_{6...8}$ = 99.88 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		659.11	
Water heating fuel used		1912.65	
Space cooling fuel used		99.88	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	323.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	323.66	(231)
Electricity for lighting		402.29	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3397.59	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	86.94	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	252.28	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	13.17	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	42.69	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	53.06	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				448.14	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	342.08	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1334.74	(265)
Space cooling	(221) x		0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.98	(267)
Electricity for lighting	(232) x		0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)…(271) =			1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.72	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2023.47	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7895.3	(265)
Space cooling	(221) x		3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	993.62	(267)
Electricity for lighting	(232) x		0	=	1235.04	(268)
'Total Primary Energy		sum of (265)…(271) =			10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.83	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 05

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.5	(1a) x	2.7	(2a) =	268.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.65	x1/[1/(1.5)+ 0.04] =	17.9			(27)
Windows Type 2			4.01	x1/[1/(1.5)+ 0.04] =	5.67			(27)
Windows Type 3			6.77	x1/[1/(1.5)+ 0.04] =	9.58			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.4	24.87	25.53	x 0.18 =	4.6			(29)
Total area of elements, m²			50.4					(31)
Party wall			70.09	x 0 =	0			(32)
Party wall			7.3	x 0 =	0			(32)
Party floor			99.5					(32a)
Party ceiling			99.5					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21258.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.14	50.87	50.61	49.4	49.17	48.11	48.11	47.91	48.52	49.17	49.63	50.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.78	94.51	94.25	93.04	92.81	91.75	91.75	91.55	92.16	92.81	93.27	93.75	

Average = Sum(39)$_{1...12}$ /12= 93.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.15 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

Total = Sum(44)$_{1...12}$ = 1189.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	

Total = Sum(45)$_{1...12}$ = 1560.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Output from water heater (annual)$_{1...12}$ — 2149.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.85	83.23	88.61	81.1	80.68	73.82	72.54	77.33	76.48	84.01	86.74	92.16	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	(71)

Water heating gains (Table 5)

(72)m=	126.15	123.86	119.1	112.63	108.44	102.53	97.5	103.94	106.23	112.92	120.48	123.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.47	469.28	454.06	429.38	404.08	379.84	364.18	370.51	383.26	408.17	436.83	458.54	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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East	0.9x	0.77	x	4.01	x	19.64	x	0.63	x	0.7	=	24.07	(76)
East	0.9x	0.77	x	4.01	x	38.42	x	0.63	x	0.7	=	47.08	(76)
East	0.9x	0.77	x	4.01	x	63.27	x	0.63	x	0.7	=	77.54	(76)
East	0.9x	0.77	x	4.01	x	92.28	x	0.63	x	0.7	=	113.09	(76)
East	0.9x	0.77	x	4.01	x	113.09	x	0.63	x	0.7	=	138.6	(76)
East	0.9x	0.77	x	4.01	x	115.77	x	0.63	x	0.7	=	141.88	(76)
East	0.9x	0.77	x	4.01	x	110.22	x	0.63	x	0.7	=	135.07	(76)
East	0.9x	0.77	x	4.01	x	94.68	x	0.63	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	4.01	x	73.59	x	0.63	x	0.7	=	90.18	(76)
East	0.9x	0.77	x	4.01	x	45.59	x	0.63	x	0.7	=	55.87	(76)
East	0.9x	0.77	x	4.01	x	24.49	x	0.63	x	0.7	=	30.01	(76)
East	0.9x	0.77	x	4.01	x	16.15	x	0.63	x	0.7	=	19.79	(76)
Southeast	0.9x	0.77	x	12.65	x	36.79	x	0.63	x	0.7	=	142.25	(77)
Southeast	0.9x	0.77	x	12.65	x	62.67	x	0.63	x	0.7	=	242.3	(77)
Southeast	0.9x	0.77	x	12.65	x	85.75	x	0.63	x	0.7	=	331.52	(77)
Southeast	0.9x	0.77	x	12.65	x	106.25	x	0.63	x	0.7	=	410.77	(77)
Southeast	0.9x	0.77	x	12.65	x	119.01	x	0.63	x	0.7	=	460.1	(77)
Southeast	0.9x	0.77	x	12.65	x	118.15	x	0.63	x	0.7	=	456.77	(77)
Southeast	0.9x	0.77	x	12.65	x	113.91	x	0.63	x	0.7	=	440.37	(77)
Southeast	0.9x	0.77	x	12.65	x	104.39	x	0.63	x	0.7	=	403.57	(77)
Southeast	0.9x	0.77	x	12.65	x	92.85	x	0.63	x	0.7	=	358.97	(77)
Southeast	0.9x	0.77	x	12.65	x	69.27	x	0.63	x	0.7	=	267.79	(77)
Southeast	0.9x	0.77	x	12.65	x	44.07	x	0.63	x	0.7	=	170.38	(77)
Southeast	0.9x	0.77	x	12.65	x	31.49	x	0.63	x	0.7	=	121.73	(77)
South	0.9x	0.77	x	6.77	x	46.75	x	0.63	x	0.7	=	96.73	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.77	x	76.57	x	0.63	x	0.7	=	158.42	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.77	x	97.53	x	0.63	x	0.7	=	201.8	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.77	x	110.23	x	0.63	x	0.7	=	228.08	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.77	x	114.87	x	0.63	x	0.7	=	237.67	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.77	x	110.55	x	0.63	x	0.7	=	228.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.77	x	108.01	x	0.63	x	0.7	=	223.48	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.77	x	104.89	x	0.63	x	0.7	=	217.03	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.77	x	101.89	x	0.63	x	0.7	=	210.8	(78)

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South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.77	x	82.59	x	0.63	x	0.7	=	170.87	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.77	x	55.42	x	0.63	x	0.7	=	114.66	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.77	x	40.4	x	0.63	x	0.7	=	83.58	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.62	481.5	653.78	800.45	886.91	876.02	846.46	782.79	704.79	530.87	339.43	242.89	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	755.09	950.78	1107.85	1229.82	1290.99	1255.86	1210.63	1153.3	1088.04	939.04	776.26	701.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	747.1	918.66	1009.64	974	799.19	545.03	363.64	381.1	587.57	791.49	754.57	696.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1450.43	1416.68	1290.33	1073.31	820.06	547.11	363.83	381.42	594.88	910.55	1199.83	1439.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.76	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	523.27	334.67	208.83	71.51	15.52	0	0	0	0	88.58	320.59	552.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	559.65	357.94	223.35	76.48	16.6	0	0	0	0	94.74	342.88	591.21	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2262.84 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	211.84	186.71	196.07	175.74	172.21	153.85	147.74	162.14	161.86	182.24	192.72	206.73	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.35	84.98	82.63	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.12	216.21	230.72	212.7	213.69	192.8	185.14	203.19	202.84	219.53	223.67	236.77	

Total = Sum(219a)$_{1...12}$ = 2580.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2262.84
Water heating fuel used		2580.37
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		402.29 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5320.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1046.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.85	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 05

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.62	**(P1)**
Transmission heat loss coefficient:	46.4	
Summer heat loss coefficient:	401.03	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	21.4	112.1	0.4	0.8	0.9	621.81	
East (E)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1313.71	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.49	491.22	500.07	
Total summer gains	1913.66	1804.93	1695.37	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.23	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.83	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:16

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 99.42m²
Site Reference : P1785 St Michaels
Plot Reference: Level 36 Flat 36 06
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.79 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.67 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	**OK**
MVHR efficiency:	88%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	6.79m²
Windows facing: South	11.46m²
Windows facing: South	2.43m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 06

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	99.42 m²	2.7 m

Living area:	48.71 m² (fraction 0.49)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	6.79	1
S	16mm or more	1	0.4	1	11.46	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	50.39	41.95	8.44	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	160.38						N/A
Party Elements							
PARTY WALLS	62.33						N/A
WALLS TO CORRIDOR	15.01						N/A
PARTY CEILING	99.42						N/A

SAP Input

PARTY FLOOR	99.42	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0784

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	32.13	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.1	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	57.08	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 83.31 (fraction 0.838)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.21 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.4	0.39	0.39	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.37	0.38	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			6.79	x 1/[1/(1)+ 0.04]		=	6.53			(27)
Windows Type 3			11.46	x 1/[1/(1)+ 0.04]		=	11.02			(27)
Windows Type 4			2.43	x 1/[1/(1)+ 0.04]		=	2.34			(27)
Walls	50.39	41.95	8.44	x	0.24	=	2.03			(29)
Total area of elements, m²			50.39							(31)
Party wall			62.33	x	0	=	0			(32)
Party wall			15.01	x	0	=	0			(32)
Party floor			99.42							(32a)
Party ceiling			99.42							(32b)
Internal wall **			160.38							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.31 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	

Average = Sum(39)$_{1...12}$ /12= 78.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56	

Output from water heater (annual)$_{1...12}$ — 1912.36 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1118.38	(98)
Space heating requirement in kWh/m²/year	11.25	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	708.37	557.66	569.15	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	693.06	551.06	560.94	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1888.77	1822.1	1730.98	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	860.91	945.66	870.51	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	2677.08	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.84	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	180.35	198.11	182.36	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	560.82	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.64	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	657.87	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56

Total = Sum(219a)$_{1...12}$ = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0

Total = Sum(221)$_{6...8}$ = 100.1 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		657.87
Water heating fuel used		1912.36
Space cooling fuel used		100.1
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	323.4	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		323.4 (231)
Electricity for lighting		402.09 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3395.82 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.3	(257)
SAP rating (Section 12)		81.83	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	341.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1333.95	(265)
Space cooling	(221) x		0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	167.84	(267)
Electricity for lighting	(232) x		0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)…(271) =			1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.73	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2019.67	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7890.63	(265)
Space cooling	(221) x		3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	992.83	(267)
Electricity for lighting	(232) x		0	=	1234.41	(268)
'Total Primary Energy		sum of (265)…(271) =			10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			104.86	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 06

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.42	(1a) x	2.7	(2a) =	268.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		268.43	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.6	x1/[1/(1.5)+ 0.04] =	17.83			(27)
Windows Type 2			4.02	x1/[1/(1.5)+ 0.04] =	5.69			(27)
Windows Type 3			6.79	x1/[1/(1.5)+ 0.04] =	9.61			(27)
Windows Type 4			1.44	x1/[1/(1.5)+ 0.04] =	2.04			(27)
Walls	50.39	24.85	25.54	x 0.18 =	4.6			(29)
Total area of elements, m²			50.39					(31)
Party wall			62.33	x 0 =	0			(32)
Party wall			15.01	x 0 =	0			(32)
Party floor			99.42					(32a)
Party ceiling			99.42					(32b)
Internal wall **			160.38					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21243.38 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.85 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.61 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.1	50.84	50.58	49.36	49.13	48.07	48.07	47.87	48.48	49.13	49.59	50.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.71	94.45	94.19	92.97	92.74	91.68	91.68	91.49	92.09	92.74	93.2	93.69	

Average = Sum(39)$_{1...12}$ /12= 92.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.73 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.13 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	

Total = Sum(44)$_{1...12}$ = 1189.62 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	

Total = Sum(45)$_{1...12}$ = 1559.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	

Output from water heater (annual)$_{1...12}$ — 2149.56 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.84	83.22	88.6	81.09	80.67	73.81	72.53	77.32	76.48	84	86.73	92.15	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	(71)

Water heating gains (Table 5)

(72)m=	126.13	123.84	119.09	112.62	108.43	102.52	97.49	103.93	106.22	112.91	120.46	123.85	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	471.3	469.11	453.9	429.23	403.94	379.71	364.05	370.39	383.13	408.03	436.68	458.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	6.79	x	46.75	x	0.63	x	0.7	=	97.02	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	6.79	x	76.57	x	0.63	x	0.7	=	158.89	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	6.79	x	97.53	x	0.63	x	0.7	=	202.39	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	6.79	x	110.23	x	0.63	x	0.7	=	228.75	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	6.79	x	114.87	x	0.63	x	0.7	=	238.37	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	6.79	x	110.55	x	0.63	x	0.7	=	229.4	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	6.79	x	108.01	x	0.63	x	0.7	=	224.14	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	6.79	x	104.89	x	0.63	x	0.7	=	217.67	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	6.79	x	101.89	x	0.63	x	0.7	=	211.42	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	6.79	x	82.59	x	0.63	x	0.7	=	171.37	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	6.79	x	55.42	x	0.63	x	0.7	=	115	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	6.79	x	40.4	x	0.63	x	0.7	=	83.83	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.63	x	0.7	=	17.78	(78)
Southwest	0.9x	0.77	x	12.6	x	36.79		0.63	x	0.7	=	141.68	(79)
Southwest	0.9x	0.77	x	12.6	x	62.67		0.63	x	0.7	=	241.34	(79)
Southwest	0.9x	0.77	x	12.6	x	85.75		0.63	x	0.7	=	330.21	(79)
Southwest	0.9x	0.77	x	12.6	x	106.25		0.63	x	0.7	=	409.15	(79)
Southwest	0.9x	0.77	x	12.6	x	119.01		0.63	x	0.7	=	458.28	(79)
Southwest	0.9x	0.77	x	12.6	x	118.15		0.63	x	0.7	=	454.96	(79)
Southwest	0.9x	0.77	x	12.6	x	113.91		0.63	x	0.7	=	438.63	(79)
Southwest	0.9x	0.77	x	12.6	x	104.39		0.63	x	0.7	=	401.98	(79)
Southwest	0.9x	0.77	x	12.6	x	92.85		0.63	x	0.7	=	357.55	(79)
Southwest	0.9x	0.77	x	12.6	x	69.27		0.63	x	0.7	=	266.73	(79)
Southwest	0.9x	0.77	x	12.6	x	44.07		0.63	x	0.7	=	169.7	(79)
Southwest	0.9x	0.77	x	12.6	x	31.49		0.63	x	0.7	=	121.25	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)

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West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23		(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41		(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32		(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41		(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01		(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09		(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.4	481.12	653.26	799.78	886.14	875.24	845.71	782.12	704.22	530.46	339.17	242.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	754.7	950.24	1107.17	1229.01	1290.08	1254.96	1209.77	1152.51	1087.35	938.49	775.85	701.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.65	0.46	0.33	0.36	0.57	0.87	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.42	20.67	20.88	20.97	21	21	21	20.99	20.85	20.47	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.51	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.05	19.38	19.73	20.01	20.12	20.15	20.15	20.15	20.14	19.99	19.47	18.99	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.6	19.89	20.19	20.44	20.54	20.56	20.57	20.57	20.56	20.41	19.96	19.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.79	0.62	0.43	0.3	0.33	0.54	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	746.71	918.12	1008.98	973.32	798.63	544.65	363.39	380.84	587.16	790.97	754.15	695.92	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1449.44	1415.72	1289.45	1072.57	819.49	546.73	363.58	381.16	594.47	909.92	1199.01	1438.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2113.98	(98)
Space heating requirement in kWh/m²/year	21.26	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
522.83	334.39	208.67	71.46	15.52	0	0	0	0	88.5	320.3	552.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
559.18	357.64	223.17	76.43	16.6	0	0	0	0	94.65	342.57	590.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2260.94	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	211.81	186.68	196.04	175.72	172.18	153.83	147.72	162.12	161.84	182.21	192.69	206.7	
Efficiency of water heater												79.8	(216)
(217)m=	87.13	86.35	84.98	82.62	80.59	79.8	79.8	79.8	79.8	83.01	86.16	87.31	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	243.09	216.19	230.69	212.67	213.66	192.77	185.11	203.16	202.81	219.51	223.65	236.74	
Total = Sum(219a)$_{1...12}$ =												2580.06	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.94	
Water heating fuel used		2580.06	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		402.09	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5318.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	488.36	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	557.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1045.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1293.26	(272)

TER = 18.79 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 06

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	354.33	**(P1)**
Transmission heat loss coefficient:	46.3	
Summer heat loss coefficient:	400.65	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	6.79	108.47	0.4	1	0.9	238.63	
South (S)	0.9 x	11.46	106.3	0.4	1	0.9	394.69	
South (S GLAZED DOOR)	0.9 x	2.43	106.3	0.4	0.7	0.9	58.58	
						Total	1309.93	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	511.3	491.04	499.89	
Total summer gains	1909.43	1800.97	1691.77	**(P5)**
Summer gain/loss ratio	4.77	4.5	4.22	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.77	22.2	21.82	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:11

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.75m²

Site Reference : P1785 St Michaels

Plot Reference: Level 36 Flat 36 07

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	20.85 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	20.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	34.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m²
Windows facing: West	8.52m²
Windows facing: North	1.57m²
Windows facing: North	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 07

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.75 m²	2.7 m

Living area:	42 m² (fraction 0.52)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SW	16mm or more	0.8	0.4	1	21.27	1
W	16mm or more	1	0.4	1	8.52	1
N	16mm or more	1	0.4	1	1.57	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SW		OPAQUE CURT WALL	South West	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.1	33.92	7.18	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.48						N/A
WALLS TO CORRIDOR	29.95						N/A
PARTY CEILING	80.75						N/A

SAP Input

PARTY FLOOR	80.75	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	45.13	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.98 (fraction 0.854)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.27	x 1/[1/(1)+ 0.04]		=	20.45			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.1	33.92	7.18	x	0.24	=	1.72			(29)
Total area of elements, m²			41.1							(31)
Party wall			35.48	x	0	=	0			(32)
Party wall			29.95	x	0	=	0			(32)
Party floor			80.75							(32a)
Party ceiling			80.75							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	

Average = Sum(39)$_{1...12}$ /12= 61.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.76 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91	

Output from water heater (annual)$_{1...12}$ — 1816.27 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42		(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31		(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6		(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8		(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67		(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84		(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	902.34	(98)
Space heating requirement in kWh/m²/year	11.17	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	561.16	441.77	451.06	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	550.19	437.01	444.67	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1516.15	1453.76	1349.69	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	695.49	756.46	673.34	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	2125.29	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.85	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	148.53	161.55	143.8	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	453.88	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.62	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	530.79	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91

Total = Sum(219a)$_{1...12}$ = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0

Total = Sum(221)$_{6...8}$ = 81.01 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		530.79	
Water heating fuel used		1816.27	
Space cooling fuel used		81.01	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	222.77		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	222.77	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2998.79	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	70.01	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.57	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	10.69	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.38	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.89	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				395.54	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.32	(257)
SAP rating (Section 12)		81.57	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	275.48	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.13	(265)
Space cooling	(221) x		0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.62	(267)
Electricity for lighting	(232) x		0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)…(271) =			1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.27	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1629.53	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7205.48	(265)
Space cooling	(221) x		3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	683.89	(267)
Electricity for lighting	(232) x		0	=	1068.21	(268)
'Total Primary Energy		sum of (265)…(271) =			9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			114.01	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.75	(1a) x	2.7	(2a) =	218.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		218.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.66	x1/[1/(1.5)+ 0.04] =	17.92			(27)
Windows Type 2			5.07	x1/[1/(1.5)+ 0.04] =	7.17			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.1	20.18	20.92	x 0.18 =	3.77			(29)
Total area of elements, m²			41.1					(31)
Party wall			35.48	x 0 =	0			(32)
Party wall			29.95	x 0 =	0			(32)
Party floor			80.75					(32a)
Party ceiling			80.75					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 17055.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.25	41.05	40.85	39.9	39.73	38.9	38.9	38.75	39.22	39.73	40.08	40.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.83	76.63	76.43	75.48	75.31	74.48	74.48	74.33	74.8	75.31	75.66	76.04	

Average = Sum(39)$_{1...12}$ /12= 75.48 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	

Total = Sum(44)$_{1...12}$ = 1116.33 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	

Total = Sum(45)$_{1...12}$ = 1463.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06	

Output from water heater (annual)$_{1...12}$ — 2053.47 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.53	80.33	85.61	78.48	78.17	71.65	70.54	75.03	74.15	81.3	83.78	88.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	(71)

Water heating gains (Table 5)

(72)m=	121.68	119.53	115.07	109	105.06	99.52	94.81	100.84	102.99	109.27	116.36	119.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	425.54	423.48	409.97	388.14	365.95	344.56	330.64	336.59	347.78	369.82	395.16	414.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	0.93	x	10.63	x	0.63	x	0.7	=	3.02	(74)
North	0.9x	0.77	x	1.52	x	10.63	x	0.63	x	0.7	=	4.94	(74)
North	0.9x	0.77	x	0.93	x	20.32	x	0.63	x	0.7	=	5.78	(74)
North	0.9x	0.77	x	1.52	x	20.32	x	0.63	x	0.7	=	9.44	(74)
North	0.9x	0.77	x	0.93	x	34.53	x	0.63	x	0.7	=	9.81	(74)
North	0.9x	0.77	x	1.52	x	34.53	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	0.93	x	55.46	x	0.63	x	0.7	=	15.76	(74)
North	0.9x	0.77	x	1.52	x	55.46	x	0.63	x	0.7	=	25.76	(74)
North	0.9x	0.77	x	0.93	x	74.72	x	0.63	x	0.7	=	21.24	(74)
North	0.9x	0.77	x	1.52	x	74.72	x	0.63	x	0.7	=	34.71	(74)
North	0.9x	0.77	x	0.93	x	79.99	x	0.63	x	0.7	=	22.73	(74)
North	0.9x	0.77	x	1.52	x	79.99	x	0.63	x	0.7	=	37.16	(74)
North	0.9x	0.77	x	0.93	x	74.68	x	0.63	x	0.7	=	21.22	(74)
North	0.9x	0.77	x	1.52	x	74.68	x	0.63	x	0.7	=	34.69	(74)
North	0.9x	0.77	x	0.93	x	59.25	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	1.52	x	59.25	x	0.63	x	0.7	=	27.52	(74)
North	0.9x	0.77	x	0.93	x	41.52	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	1.52	x	41.52	x	0.63	x	0.7	=	19.29	(74)
North	0.9x	0.77	x	0.93	x	24.19	x	0.63	x	0.7	=	6.88	(74)
North	0.9x	0.77	x	1.52	x	24.19	x	0.63	x	0.7	=	11.24	(74)
North	0.9x	0.77	x	0.93	x	13.12	x	0.63	x	0.7	=	3.73	(74)
North	0.9x	0.77	x	1.52	x	13.12	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	0.93	x	8.86	x	0.63	x	0.7	=	2.52	(74)
North	0.9x	0.77	x	1.52	x	8.86	x	0.63	x	0.7	=	4.12	(74)
Southwest	0.9x	0.77	x	12.66	x	36.79		0.63	x	0.7	=	142.36	(79)
Southwest	0.9x	0.77	x	12.66	x	62.67		0.63	x	0.7	=	242.49	(79)
Southwest	0.9x	0.77	x	12.66	x	85.75		0.63	x	0.7	=	331.78	(79)
Southwest	0.9x	0.77	x	12.66	x	106.25		0.63	x	0.7	=	411.09	(79)
Southwest	0.9x	0.77	x	12.66	x	119.01		0.63	x	0.7	=	460.46	(79)
Southwest	0.9x	0.77	x	12.66	x	118.15		0.63	x	0.7	=	457.13	(79)
Southwest	0.9x	0.77	x	12.66	x	113.91		0.63	x	0.7	=	440.72	(79)
Southwest	0.9x	0.77	x	12.66	x	104.39		0.63	x	0.7	=	403.89	(79)
Southwest	0.9x	0.77	x	12.66	x	92.85		0.63	x	0.7	=	359.25	(79)
Southwest	0.9x	0.77	x	12.66	x	69.27		0.63	x	0.7	=	268	(79)
Southwest	0.9x	0.77	x	12.66	x	44.07		0.63	x	0.7	=	170.51	(79)
Southwest	0.9x	0.77	x	12.66	x	31.49		0.63	x	0.7	=	121.83	(79)
West	0.9x	0.77	x	5.07	x	19.64	x	0.63	x	0.7	=	30.43	(80)
West	0.9x	0.77	x	5.07	x	38.42	x	0.63	x	0.7	=	59.53	(80)
West	0.9x	0.77	x	5.07	x	63.27	x	0.63	x	0.7	=	98.04	(80)
West	0.9x	0.77	x	5.07	x	92.28	x	0.63	x	0.7	=	142.98	(80)
West	0.9x	0.77	x	5.07	x	113.09	x	0.63	x	0.7	=	175.23	(80)

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West	0.9x	0.77	x	5.07	x	115.77	x	0.63	x	0.7	=	179.38		(80)
West	0.9x	0.77	x	5.07	x	110.22	x	0.63	x	0.7	=	170.78		(80)
West	0.9x	0.77	x	5.07	x	94.68	x	0.63	x	0.7	=	146.7		(80)
West	0.9x	0.77	x	5.07	x	73.59	x	0.63	x	0.7	=	114.02		(80)
West	0.9x	0.77	x	5.07	x	45.59	x	0.63	x	0.7	=	70.64		(80)
West	0.9x	0.77	x	5.07	x	24.49	x	0.63	x	0.7	=	37.94		(80)
West	0.9x	0.77	x	5.07	x	16.15	x	0.63	x	0.7	=	25.03		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.75	317.23	455.68	595.61	691.64	696.4	667.41	594.95	504.36	356.75	218.28	153.49	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.29	740.71	865.65	983.75	1057.59	1040.96	998.06	931.54	852.14	726.57	613.44	567.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.37	0.59	0.89	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.18	20.39	20.64	20.87	20.97	21	21	21	20.99	20.83	20.46	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.15	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.26	0.3	0.53	0.85	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.04	19.34	19.7	20	20.12	20.15	20.15	20.15	20.14	19.96	19.45	18.99	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.88	20.19	20.46	20.56	20.59	20.59	20.59	20.58	20.41	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.62	0.43	0.3	0.33	0.56	0.86	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	600.25	719.7	798.5	787.05	650.96	444.53	297.13	311.3	477.42	627.49	598.27	563.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.9	1148.12	1046.12	872.33	667.44	446.09	297.28	311.58	484.64	739.11	974.05	1169.87	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1780.23	(98)
Space heating requirement in kWh/m²/year	22.05	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
429.78	287.9	184.23	61.4	12.26	0	0	0	0	83.04	270.56	451.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
459.65	307.92	197.03	65.67	13.11	0	0	0	0	88.81	289.37	482.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	1903.99	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$=	0	(215)

Water heating

Output from water heater (calculated above)

	201.84	177.97	187.05	167.88	164.66	147.34	141.71	155.22	154.86	174.07	183.81	197.06

Efficiency of water heater	79.8	(216)

(217)m=	86.78	86.09	84.77	82.41	80.46	79.8	79.8	79.8	79.8	82.97	85.84	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	232.59	206.72	220.65	203.71	204.65	184.64	177.58	194.51	194.06	209.81	214.12	226.62

Total = Sum(219a)$_{1...12}$ =	2469.66	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1903.99	
Water heating fuel used		2469.66	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		347.95	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4796.6	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	411.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			944.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year	sum of (265)…(271) =			1164.22	(272)

TER = 20.85 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 07

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	287.79	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	325.49	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	0.9 x	21.27	112.1	0.4	0.8	0.9	618.03	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
						Total	997.51	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	458.05	440.16	448.28	
Total summer gains	1532.02	1437.67	1320.98	**(P5)**
Summer gain/loss ratio	4.71	4.42	4.06	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.71	22.12	21.66	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:06

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 80.45m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 36 Flat 36 08

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.21 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	34.4 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	**OK**
MVHR efficiency:	89%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m²
Windows facing: West	8.52m²
Windows facing: South	1.57m²
Windows facing: South	2.56m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 36 Flat 36 08

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	80.45 m²	2.7 m

Living area:	41.95 m² (fraction 0.521)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	21.25	1
W	16mm or more	1	0.4	1	8.52	1
S	16mm or more	1	0.4	1	1.57	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
W		OPAQUE CURT WALL	West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	41.22	33.9	7.32	0.24	0	True	N/A
Internal Elements							
INT WALLS	102.06						N/A
Party Elements							
PARTY WALLS	35.41						N/A
WALLS TO CORRIDOR	29.66						N/A
PARTY CEILING	80.45						N/A

SAP Input

PARTY FLOOR	80.45	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0814

	Length	Psi-value		
[Approved]	22.99	0.05	E4	Jamb
[Approved]	25.49	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	4.95	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	48.21	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.15
Compressor control: Systems with variable speed compressors
Cooled area: 68.84 (fraction 0.856)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.25	x 1/[1/(1)+ 0.04]		=	20.43			(27)
Windows Type 2			8.52	x 1/[1/(1)+ 0.04]		=	8.19			(27)
Windows Type 3			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Walls	41.22	33.9	7.32	x	0.24	=	1.76			(29)
Total area of elements, m²			41.22							(31)
Party wall			35.41	x	0	=	0			(32)
Party wall			29.66	x	0	=	0			(32)
Party floor			80.45							(32a)
Party ceiling			80.45							(32b)
Internal wall **			102.06							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.36 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 37.71 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76	

Average = Sum(39)$_{1...12}$ /12= 61.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78	

Average = Sum(40)$_{1...12}$ /12= 0.77 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7	

Output from water heater (annual)$_{1...12}$ — 1814.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest	0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest	0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest	0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest	0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest	0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest	0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest	0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1071.67	(98)
Space heating requirement in kWh/m²/year	13.32	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	560.53	441.27	450.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	547.56	435.46	441.93	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1433.45	1362.9	1222.95	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	637.84	690.01	581.08	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	1908.93	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.86	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	136.45	147.61	124.3	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	408.36	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	5.08	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.6	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	630.39	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7

Total = Sum(219a)$_{1...12}$ = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	24.35	26.35	22.19	0	0	0	0

Total = Sum(221)$_{6...8}$ = 72.89 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		630.39	
Water heating fuel used		1814.18	
Space cooling fuel used		72.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	221.94		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	221.94	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3086.37	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	83.15	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243)	x	13.19	x 0.01 =	239.29	(245)
Low-rate cost	(219) x (244)	x	13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	9.61	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	29.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	45.77	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				407.09	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.36	(257)
SAP rating (Section 12)		80.99	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	327.17	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1268.73	(265)
Space cooling	(221) x		0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	115.19	(267)
Electricity for lighting	(232) x		0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)…(271) =			1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =			19.91	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	1935.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7504.85	(265)
Space cooling	(221) x		3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	681.35	(267)
Electricity for lighting	(232) x		0	=	1065.2	(268)
'Total Primary Energy		sum of (265)…(271) =			9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			117.78	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 36 Flat 36 08

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.45	(1a) x	2.7	(2a) =	217.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			12.61	x1/[1/(1.5)+ 0.04] =	17.84			(27)
Windows Type 2			5.05	x1/[1/(1.5)+ 0.04] =	7.15			(27)
Windows Type 3			0.93	x1/[1/(1.5)+ 0.04] =	1.32			(27)
Windows Type 4			1.52	x1/[1/(1.5)+ 0.04] =	2.15			(27)
Walls	41.22	20.11	21.11	x 0.18 =	3.8			(29)
Total area of elements, m²			41.22					(31)
Party wall			35.41	x 0 =	0			(32)
Party wall			29.66	x 0 =	0			(32)
Party floor			80.45					(32a)
Party ceiling			80.45					(32b)
Internal wall **			102.06					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.26 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16996.48 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.52 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.11	40.91	40.71	39.76	39.59	38.77	38.77	38.61	39.08	39.59	39.94	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	76.63	76.42	76.22	75.28	75.1	74.28	74.28	74.13	74.6	75.1	75.46	75.83	

Average = Sum(39)$_{1...12}$ /12= 75.28 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.95	0.95	0.95	0.94	0.93	0.92	0.92	0.92	0.93	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18	

Total = Sum(44)$_{1...12}$ = 1114.73 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75	

Total = Sum(45)$_{1...12}$ = 1461.59 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	

Output from water heater (annual)$_{1...12}$ — 2051.38 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.46	80.26	85.55	78.43	78.11	71.61	70.49	74.98	74.1	81.24	83.72	88.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	(71)

Water heating gains (Table 5)

(72)m=	121.58	119.44	114.98	108.92	104.99	99.45	94.75	100.78	102.92	109.19	116.27	119.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	424.68	422.62	409.15	387.37	365.24	343.9	330.01	335.95	347.12	369.1	394.38	413.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	0.93	x	46.75	x	0.63	x	0.7	=	13.29	(78)
South	0.9x	0.77	x	1.52	x	46.75	x	0.63	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.93	x	76.57	x	0.63	x	0.7	=	21.76	(78)
South	0.9x	0.77	x	1.52	x	76.57	x	0.63	x	0.7	=	35.57	(78)
South	0.9x	0.77	x	0.93	x	97.53	x	0.63	x	0.7	=	27.72	(78)
South	0.9x	0.77	x	1.52	x	97.53	x	0.63	x	0.7	=	45.31	(78)
South	0.9x	0.77	x	0.93	x	110.23	x	0.63	x	0.7	=	31.33	(78)
South	0.9x	0.77	x	1.52	x	110.23	x	0.63	x	0.7	=	51.21	(78)
South	0.9x	0.77	x	0.93	x	114.87	x	0.63	x	0.7	=	32.65	(78)
South	0.9x	0.77	x	1.52	x	114.87	x	0.63	x	0.7	=	53.36	(78)
South	0.9x	0.77	x	0.93	x	110.55	x	0.63	x	0.7	=	31.42	(78)
South	0.9x	0.77	x	1.52	x	110.55	x	0.63	x	0.7	=	51.35	(78)
South	0.9x	0.77	x	0.93	x	108.01	x	0.63	x	0.7	=	30.7	(78)
South	0.9x	0.77	x	1.52	x	108.01	x	0.63	x	0.7	=	50.17	(78)
South	0.9x	0.77	x	0.93	x	104.89	x	0.63	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	1.52	x	104.89	x	0.63	x	0.7	=	48.73	(78)
South	0.9x	0.77	x	0.93	x	101.89	x	0.63	x	0.7	=	28.96	(78)
South	0.9x	0.77	x	1.52	x	101.89	x	0.63	x	0.7	=	47.33	(78)
South	0.9x	0.77	x	0.93	x	82.59	x	0.63	x	0.7	=	23.47	(78)
South	0.9x	0.77	x	1.52	x	82.59	x	0.63	x	0.7	=	38.36	(78)
South	0.9x	0.77	x	0.93	x	55.42	x	0.63	x	0.7	=	15.75	(78)
South	0.9x	0.77	x	1.52	x	55.42	x	0.63	x	0.7	=	25.74	(78)
South	0.9x	0.77	x	0.93	x	40.4	x	0.63	x	0.7	=	11.48	(78)
South	0.9x	0.77	x	1.52	x	40.4	x	0.63	x	0.7	=	18.77	(78)
West	0.9x	0.77	x	5.05	x	19.64	x	0.63	x	0.7	=	30.31	(80)
West	0.9x	0.77	x	5.05	x	38.42	x	0.63	x	0.7	=	59.3	(80)
West	0.9x	0.77	x	5.05	x	63.27	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	5.05	x	92.28	x	0.63	x	0.7	=	142.42	(80)
West	0.9x	0.77	x	5.05	x	113.09	x	0.63	x	0.7	=	174.54	(80)
West	0.9x	0.77	x	5.05	x	115.77	x	0.63	x	0.7	=	178.67	(80)
West	0.9x	0.77	x	5.05	x	110.22	x	0.63	x	0.7	=	170.1	(80)
West	0.9x	0.77	x	5.05	x	94.68	x	0.63	x	0.7	=	146.12	(80)
West	0.9x	0.77	x	5.05	x	73.59	x	0.63	x	0.7	=	113.57	(80)
West	0.9x	0.77	x	5.05	x	45.59	x	0.63	x	0.7	=	70.36	(80)
West	0.9x	0.77	x	5.05	x	24.49	x	0.63	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	5.05	x	16.15	x	0.63	x	0.7	=	24.93	(80)
Northwest	0.9x	0.77	x	12.61	x	11.28	x	0.63	x	0.7	=	43.48	(81)
Northwest	0.9x	0.77	x	12.61	x	22.97	x	0.63	x	0.7	=	88.51	(81)
Northwest	0.9x	0.77	x	12.61	x	41.38	x	0.63	x	0.7	=	159.46	(81)
Northwest	0.9x	0.77	x	12.61	x	67.96	x	0.63	x	0.7	=	261.89	(81)
Northwest	0.9x	0.77	x	12.61	x	91.35	x	0.63	x	0.7	=	352.03	(81)

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Northwest	0.9x	0.77	x	12.61	x	97.38	x	0.63	x	0.7	=	375.3	(81)
Northwest	0.9x	0.77	x	12.61	x	91.1	x	0.63	x	0.7	=	351.08	(81)
Northwest	0.9x	0.77	x	12.61	x	72.63	x	0.63	x	0.7	=	279.89	(81)
Northwest	0.9x	0.77	x	12.61	x	50.42	x	0.63	x	0.7	=	194.31	(81)
Northwest	0.9x	0.77	x	12.61	x	28.07	x	0.63	x	0.7	=	108.16	(81)
Northwest	0.9x	0.77	x	12.61	x	14.2	x	0.63	x	0.7	=	54.71	(81)
Northwest	0.9x	0.77	x	12.61	x	9.21	x	0.63	x	0.7	=	35.51	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	108.8	205.14	330.15	486.85	612.58	636.75	602.06	504.55	384.17	240.36	134	90.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.48	627.76	739.29	874.22	977.82	980.64	932.08	840.5	731.29	609.46	528.38	504.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.68	0.48	0.35	0.4	0.68	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.26	20.53	20.82	20.96	21	21	21	20.98	20.75	20.36	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.91	19.16	19.54	19.94	20.11	20.15	20.15	20.15	20.13	19.86	19.31	18.88	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.74	20.05	20.4	20.55	20.59	20.59	20.59	20.57	20.32	19.86	19.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.85	0.66	0.45	0.32	0.37	0.64	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	530.52	618.91	706.72	744.69	642.02	442.77	296.31	310.27	468.21	561.48	521.51	501.98	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1167	1133.74	1033.12	865.69	664.97	444.88	296.52	310.76	482.59	730.06	962.94	1159.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2099.34	(98)
Space heating requirement in kWh/m²/year	26.1	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
473.54	345.97	242.85	87.12	17.07	0	0	0	0	125.43	317.83	489.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
506.46	370.02	259.73	93.18	18.26	0	0	0	0	134.15	339.92	523.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	2245.29	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	201.63	177.78	186.86	167.71	164.5	147.2	141.57	155.07	154.71	173.89	183.62	196.85	
Efficiency of water heater												79.8	(216)
(217)m=	87.02	86.56	85.51	83.16	80.7	79.8	79.8	79.8	79.8	83.96	86.26	87.15	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	231.71	205.38	218.51	201.67	203.85	184.46	177.41	194.32	193.87	207.12	212.85	225.87	
Total = Sum(219a)$_{1...12}$ =												2457.03	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2245.29	
Water heating fuel used		2457.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		346.97	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5124.29	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	484.98	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	530.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1015.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.7	(272)

TER = 22.29 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 36 Flat 36 08

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	286.72	**(P1)**
Transmission heat loss coefficient:	37.7	
Summer heat loss coefficient:	324.43	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	21.25	89.66	0.4	0.8	0.9	493.82	
West (W)	0.9 x	8.52	108.47	0.4	1	0.9	299.43	
South (S)	0.9 x	1.57	106.3	0.4	1	0.9	54.07	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
						Total	909.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	457.05	439.2	447.31	
Total summer gains	1448.1	1348.23	1198.25	**(P5)**
Summer gain/loss ratio	4.46	4.16	3.69	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.46	21.86	21.29	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:32:44

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 218.74m²
Site Reference : P1785 St Michaels
Plot Reference: Level 37 Flat 37 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.54 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.60 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	41.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.85 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	33.34m²
Windows facing: North East	31.09m²
Windows facing: North	22.53m²
Windows facing: North	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 37 Flat 37 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	218.74 m²	2.7 m

Living area:	99.26 m² (fraction 0.454)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	33.34	1
NE	16mm or more	0.8	0.4	1	31.09	1
N	16mm or more	1	0.4	1	22.53	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
NE		OPAQUE CURT WALL	North East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	115.29	91.81	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	354.24						N/A
Party Elements							
PARTY WALLS	40.89						N/A
WALLS TO CORRIDOR	40.3						N/A
PARTY CEILING	218.74						N/A

SAP Input

PARTY FLOOR 218.74 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0844

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.58	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 1
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 167.89 (fraction 0.768)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.23 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			31.09	x 1/[1/(1)+ 0.04]		=	29.89			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	115.29	91.81	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			115.29							(31)
Party wall			40.89	x	0	=	0			(32)
Party wall			40.3	x	0	=	0			(32)
Party floor			218.74							(32a)
Party ceiling			218.74							(32b)
Internal wall **			354.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 44513.88 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	80.36	79.24	78.11	72.48	71.35	65.72	65.72	64.59	67.97	71.35	73.6	75.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	184	182.88	181.75	176.12	174.99	169.36	169.36	168.23	171.61	174.99	177.24	179.5	

Average = Sum(39)$_{1...12}$ /12= 175.84 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.83	0.81	0.8	0.77	0.77	0.77	0.78	0.8	0.81	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	

Output from water heater (annual)$_{1...12}$ — 2021.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.49	71.96	75.88	68.45	67.39	60.67	58.69	63.81	63.52	70.96	74.49	79.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	86.59	76.91	62.55	47.35	35.4	29.88	32.29	41.97	56.34	71.53	83.49	89	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	579.89	585.91	570.74	538.46	497.71	459.41	433.82	427.81	442.97	475.25	516	554.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	109.53	107.08	101.99	95.08	90.58	84.26	78.89	85.77	88.22	95.38	103.46	107.09	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	892.72	886.61	851.99	797.6	740.4	690.26	661.71	672.26	704.24	758.87	819.66	867.1	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	22.53	x	10.63	x	0.4	x	1	=	66.41	(74)
North	0.9x	0.77	x	4.85	x	10.63	x	0.4	x	0.7	=	10.01	(74)
North	0.9x	0.77	x	22.53	x	20.32	x	0.4	x	1	=	126.91	(74)
North	0.9x	0.77	x	4.85	x	20.32	x	0.4	x	0.7	=	19.12	(74)
North	0.9x	0.77	x	22.53	x	34.53	x	0.4	x	1	=	215.65	(74)
North	0.9x	0.77	x	4.85	x	34.53	x	0.4	x	0.7	=	32.5	(74)
North	0.9x	0.77	x	22.53	x	55.46	x	0.4	x	1	=	346.39	(74)
North	0.9x	0.77	x	4.85	x	55.46	x	0.4	x	0.7	=	52.2	(74)
North	0.9x	0.77	x	22.53	x	74.72	x	0.4	x	1	=	466.62	(74)
North	0.9x	0.77	x	4.85	x	74.72	x	0.4	x	0.7	=	70.31	(74)
North	0.9x	0.77	x	22.53	x	79.99	x	0.4	x	1	=	499.53	(74)
North	0.9x	0.77	x	4.85	x	79.99	x	0.4	x	0.7	=	75.27	(74)
North	0.9x	0.77	x	22.53	x	74.68	x	0.4	x	1	=	466.38	(74)
North	0.9x	0.77	x	4.85	x	74.68	x	0.4	x	0.7	=	70.28	(74)
North	0.9x	0.77	x	22.53	x	59.25	x	0.4	x	1	=	370.01	(74)
North	0.9x	0.77	x	4.85	x	59.25	x	0.4	x	0.7	=	55.76	(74)
North	0.9x	0.77	x	22.53	x	41.52	x	0.4	x	1	=	259.28	(74)
North	0.9x	0.77	x	4.85	x	41.52	x	0.4	x	0.7	=	39.07	(74)
North	0.9x	0.77	x	22.53	x	24.19	x	0.4	x	1	=	151.07	(74)
North	0.9x	0.77	x	4.85	x	24.19	x	0.4	x	0.7	=	22.76	(74)
North	0.9x	0.77	x	22.53	x	13.12	x	0.4	x	1	=	81.92	(74)
North	0.9x	0.77	x	4.85	x	13.12	x	0.4	x	0.7	=	12.34	(74)
North	0.9x	0.77	x	22.53	x	8.86	x	0.4	x	1	=	55.36	(74)
North	0.9x	0.77	x	4.85	x	8.86	x	0.4	x	0.7	=	8.34	(74)
Northeast	0.9x	0.77	x	31.09	x	11.28	x	0.4	x	0.8	=	77.79	(75)
Northeast	0.9x	0.77	x	31.09	x	22.97	x	0.4	x	0.8	=	158.34	(75)
Northeast	0.9x	0.77	x	31.09	x	41.38	x	0.4	x	0.8	=	285.29	(75)
Northeast	0.9x	0.77	x	31.09	x	67.96	x	0.4	x	0.8	=	468.52	(75)
Northeast	0.9x	0.77	x	31.09	x	91.35	x	0.4	x	0.8	=	629.79	(75)
Northeast	0.9x	0.77	x	31.09	x	97.38	x	0.4	x	0.8	=	671.42	(75)
Northeast	0.9x	0.77	x	31.09	x	91.1	x	0.4	x	0.8	=	628.1	(75)
Northeast	0.9x	0.77	x	31.09	x	72.63	x	0.4	x	0.8	=	500.73	(75)
Northeast	0.9x	0.77	x	31.09	x	50.42	x	0.4	x	0.8	=	347.63	(75)
Northeast	0.9x	0.77	x	31.09	x	28.07	x	0.4	x	0.8	=	193.51	(75)
Northeast	0.9x	0.77	x	31.09	x	14.2	x	0.4	x	0.8	=	97.88	(75)
Northeast	0.9x	0.77	x	31.09	x	9.21	x	0.4	x	0.8	=	63.53	(75)
Northwest	0.9x	0.77	x	33.34	x	11.28	x	0.4	x	0.8	=	83.42	(81)
Northwest	0.9x	0.77	x	33.34	x	22.97	x	0.4	x	0.8	=	169.8	(81)
Northwest	0.9x	0.77	x	33.34	x	41.38	x	0.4	x	0.8	=	305.93	(81)
Northwest	0.9x	0.77	x	33.34	x	67.96	x	0.4	x	0.8	=	502.43	(81)
Northwest	0.9x	0.77	x	33.34	x	91.35	x	0.4	x	0.8	=	675.36	(81)

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Northwest	0.9x	0.77	x	33.34	x	97.38	x	0.4	x	0.8	=	720.01	(81)
Northwest	0.9x	0.77	x	33.34	x	91.1	x	0.4	x	0.8	=	673.55	(81)
Northwest	0.9x	0.77	x	33.34	x	72.63	x	0.4	x	0.8	=	536.97	(81)
Northwest	0.9x	0.77	x	33.34	x	50.42	x	0.4	x	0.8	=	372.78	(81)
Northwest	0.9x	0.77	x	33.34	x	28.07	x	0.4	x	0.8	=	207.51	(81)
Northwest	0.9x	0.77	x	33.34	x	14.2	x	0.4	x	0.8	=	104.96	(81)
Northwest	0.9x	0.77	x	33.34	x	9.21	x	0.4	x	0.8	=	68.13	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	237.63	474.18	839.37	1369.54	1842.09	1966.24	1838.31	1463.46	1018.77	574.86	297.11	195.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1130.35	1360.79	1691.36	2167.14	2582.49	2656.5	2500.02	2135.72	1723	1333.73	1116.78	1062.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.9	0.76	0.57	0.4	0.29	0.35	0.61	0.87	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.2	19.49	19.98	20.55	20.86	20.97	20.99	20.99	20.88	20.39	19.71	19.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.23	20.25	20.25	20.28	20.28	20.28	20.27	20.25	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.89	0.74	0.54	0.35	0.25	0.3	0.56	0.85	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.76	18.19	18.89	19.7	20.1	20.25	20.27	20.27	20.14	19.5	18.53	17.75	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.87	0.73	0.54	0.37	0.27	0.33	0.58	0.84	0.94	0.97	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1084.44	1269.12	1471.42	1581.21	1407.26	988.03	671.12	694.65	993.53	1117.84	1048.06	1025.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2596.98	2538.45	2341.19	1970.13	1530.08	1012.11	677.01	705.57	1094.31	1627.57	2120.42	2548.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5280.94	(98)
Space heating requirement in kWh/m²/year	24.14	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1591.95	1253.24	1278.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.96	0.94	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1498.19	1207.04	1202.66	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2988.46	2810.38	2382.8	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1072.99	1192.89	878.03	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	3143.91	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.77	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	205.89	228.9	168.48	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	603.26	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	2.76	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	661.96	501.76	380.65	164.72	53.75	0	0	0	0	223.08	454.17	666.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	3106.43	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Total = Sum(219a)$_{1...12}$ = 2021.55 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	34.66	38.53	28.36	0	0	0	0

Total = Sum(221)$_{6...8}$ = 101.56 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3106.43
Water heating fuel used		2021.55
Space cooling fuel used		101.56
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	666.49	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		666.49 (231)
Electricity for lighting		611.71 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6507.74 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	409.74 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	266.64 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.4 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	87.91 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	80.68 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		858.37 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.93	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	1612.24	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1049.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2661.43	(265)
Space cooling	(221) x		0.519	=	52.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	345.91	(267)
Electricity for lighting	(232) x		0.519	=	317.48	(268)
Total CO2, kg/year		sum of (265)…(271) =			3377.52	(272)
CO2 emissions per m²		(272) ÷ (4) =			15.44	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	9536.75	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6206.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				15742.92	(265)
Space cooling	(221) x		3.07	=	311.79	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	2046.12	(267)
Electricity for lighting	(232) x		0	=	1877.94	(268)
'Total Primary Energy		sum of (265)…(271) =			19978.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			91.34	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.07 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.32 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 2			18.52	x1/[1/(1.5)+ 0.04] =	26.21			(27)
Windows Type 3			13.42	x1/[1/(1.5)+ 0.04] =	18.99			(27)
Windows Type 4			2.89	x1/[1/(1.5)+ 0.04] =	4.09			(27)
Walls	115.29	54.69	60.6	x 0.18 =	10.91			(29)
Total area of elements, m²			115.29					(31)
Party wall			40.89	x 0 =	0			(32)
Party wall			40.3	x 0 =	0			(32)
Party floor			218.74					(32a)
Party ceiling			218.74					(32b)
Internal wall **			354.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 88.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 45033.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.5 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 97.8 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	111.13	110.6	110.08	107.63	107.18	105.05	105.05	104.65	105.87	107.18	108.1	109.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	208.94	208.4	207.88	205.44	204.98	202.85	202.85	202.45	203.67	204.98	205.91	206.87	

Average = Sum(39)$_{1...12}$ /12= 205.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	

Output from water heater (annual)$_{1...12}$ — 2258.75 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.61	86.52	92	84.05	83.51	76.26	74.81	79.93	79.11	87.08	90.09	95.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	34.64	30.76	25.02	18.94	14.16	11.95	12.92	16.79	22.53	28.61	33.39	35.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	388.52	392.56	382.4	360.77	333.47	307.81	290.66	286.63	296.79	318.42	345.72	371.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	131.19	128.74	123.65	116.74	112.25	105.92	100.55	107.43	109.88	117.04	125.13	128.75	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	625.75	623.46	602.47	567.84	531.27	497.08	475.52	482.25	500.6	535.47	575.64	607.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	13.42	x	10.63	x	0.63	x	0.7	=	43.61	(74)
North	0.9x	0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x	0.77	x	13.42	x	20.32	x	0.63	x	0.7	=	83.34	(74)
North	0.9x	0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x	0.77	x	13.42	x	34.53	x	0.63	x	0.7	=	141.62	(74)
North	0.9x	0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x	0.77	x	13.42	x	55.46	x	0.63	x	0.7	=	227.48	(74)
North	0.9x	0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x	0.77	x	13.42	x	74.72	x	0.63	x	0.7	=	306.43	(74)
North	0.9x	0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x	0.77	x	13.42	x	79.99	x	0.63	x	0.7	=	328.05	(74)
North	0.9x	0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x	0.77	x	13.42	x	74.68	x	0.63	x	0.7	=	306.27	(74)
North	0.9x	0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	13.42	x	59.25	x	0.63	x	0.7	=	242.99	(74)
North	0.9x	0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x	0.77	x	13.42	x	41.52	x	0.63	x	0.7	=	170.27	(74)
North	0.9x	0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x	0.77	x	13.42	x	24.19	x	0.63	x	0.7	=	99.21	(74)
North	0.9x	0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x	0.77	x	13.42	x	13.12	x	0.63	x	0.7	=	53.8	(74)
North	0.9x	0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x	0.77	x	13.42	x	8.86	x	0.63	x	0.7	=	36.36	(74)
North	0.9x	0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
Northeast	0.9x	0.77	x	18.52	x	11.28	x	0.63	x	0.7	=	63.86	(75)
Northeast	0.9x	0.77	x	18.52	x	22.97	x	0.63	x	0.7	=	129.99	(75)
Northeast	0.9x	0.77	x	18.52	x	41.38	x	0.63	x	0.7	=	234.2	(75)
Northeast	0.9x	0.77	x	18.52	x	67.96	x	0.63	x	0.7	=	384.63	(75)
Northeast	0.9x	0.77	x	18.52	x	91.35	x	0.63	x	0.7	=	517.01	(75)
Northeast	0.9x	0.77	x	18.52	x	97.38	x	0.63	x	0.7	=	551.19	(75)
Northeast	0.9x	0.77	x	18.52	x	91.1	x	0.63	x	0.7	=	515.63	(75)
Northeast	0.9x	0.77	x	18.52	x	72.63	x	0.63	x	0.7	=	411.06	(75)
Northeast	0.9x	0.77	x	18.52	x	50.42	x	0.63	x	0.7	=	285.38	(75)
Northeast	0.9x	0.77	x	18.52	x	28.07	x	0.63	x	0.7	=	158.86	(75)
Northeast	0.9x	0.77	x	18.52	x	14.2	x	0.63	x	0.7	=	80.35	(75)
Northeast	0.9x	0.77	x	18.52	x	9.21	x	0.63	x	0.7	=	52.15	(75)
Northwest	0.9x	0.77	x	19.86	x	11.28	x	0.63	x	0.7	=	68.48	(81)
Northwest	0.9x	0.77	x	19.86	x	22.97	x	0.63	x	0.7	=	139.4	(81)
Northwest	0.9x	0.77	x	19.86	x	41.38	x	0.63	x	0.7	=	251.15	(81)
Northwest	0.9x	0.77	x	19.86	x	67.96	x	0.63	x	0.7	=	412.46	(81)
Northwest	0.9x	0.77	x	19.86	x	91.35	x	0.63	x	0.7	=	554.42	(81)

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Northwest	0.9x	0.77	x	19.86	x	97.38	x	0.63	x	0.7	=	591.07	(81)
Northwest	0.9x	0.77	x	19.86	x	91.1	x	0.63	x	0.7	=	552.94	(81)
Northwest	0.9x	0.77	x	19.86	x	72.63	x	0.63	x	0.7	=	440.81	(81)
Northwest	0.9x	0.77	x	19.86	x	50.42	x	0.63	x	0.7	=	306.03	(81)
Northwest	0.9x	0.77	x	19.86	x	28.07	x	0.63	x	0.7	=	170.35	(81)
Northwest	0.9x	0.77	x	19.86	x	14.2	x	0.63	x	0.7	=	86.17	(81)
Northwest	0.9x	0.77	x	19.86	x	9.21	x	0.63	x	0.7	=	55.93	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.35	370.68	657.47	1073.55	1443.86	1540.95	1440.79	1147.19	798.35	449.79	231.91	152.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	811.09	994.14	1259.93	1641.39	1975.12	2038.03	1916.31	1629.44	1298.95	985.25	807.54	759.39	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.97	0.84	0.62	0.46	0.56	0.89	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.95	20.22	20.6	20.89	20.99	21	20.99	20.89	20.49	20.08	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.13	20.14	20.14	20.14	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.96	0.79	0.54	0.37	0.46	0.83	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.7	19.09	19.65	20.03	20.13	20.14	20.14	20.04	19.5	18.91	18.47	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.81	0.58	0.41	0.51	0.85	0.99	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	810.85	993.1	1252.57	1570.68	1599.7	1179.74	794.99	828.47	1108.12	975.94	806.92	759.24	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3090.25	2994.2	2724.06	2297.4	1787.46	1201.01	797.43	835.95	1288.49	1915.57	2540.88	3076.16	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8469.65	(98)
Space heating requirement in kWh/m²/year	38.72	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
1813.76	1438.22	1170.89	559.62	149.4	0	0	0	0	747.69	1335.24	1843.62	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	9058.45	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	
Efficiency of water heater												79.8	(216)
(217)m=	89.11	88.98	88.62	87.44	84.14	79.8	79.8	79.8	79.8	87.96	88.84	89.16	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	250.39	220.93	232.76	211.14	214.81	202.02	193.68	212.99	212.76	217.66	228.28	244.13	
Total = Sum(219a)$_{1...12}$ =												2641.53	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		9058.45	
Water heating fuel used		2641.53	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		611.71	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		12386.69	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	1956.63	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	570.57	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2527.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	317.48	(268)
Total CO2, kg/year	sum of (265)…(271) =			2883.6	(272)

TER = 19.54 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 37 Flat 37 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	779.59	**(P1)**
Transmission heat loss coefficient:	103.6	
Summer heat loss coefficient:	883.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
North East (NE)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	33.34	89.66	0.4	0.8	0.9	774.78	
North East (NE)	0.9 x	31.09	89.66	0.4	0.8	0.9	722.49	
North (N)	0.9 x	22.53	73.49	0.4	1	0.9	536.47	
North (N GLAZED DOOR)	0.9 x	4.85	73.49	0.4	0.7	0.9	80.84	
						Total	2114.57	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	690.26	661.71	672.26	
Total summer gains	3022.94	2776.28	2328.33	**(P5)**
Summer gain/loss ratio	3.42	3.14	2.64	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.42	20.84	20.24	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Not significant**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:32:35

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 121.32m²
Site Reference : P1785 St Michaels
Plot Reference: Level 37 Flat 37 02
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.47 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: East	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 37 Flat 37 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	121.32 m²	2.7 m
Living area:	62.23 m² (fraction 0.513)	
Front of dwelling faces:	West	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	0.8	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	55.49	46.1	9.39	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	44.87						N/A
PARTY CEILING	121.32						N/A
PARTY FLOOR	121.32						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0736

	Length	Psi-value		
[Approved]	28.1	0.05	E4	Jamb
[Approved]	30.74	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.25	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.91	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 105.55 (fraction 0.870)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32	(1a) x	2.7	(2a) =	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x	1/[1/(1)+ 0.04]	=	9.31			(27)
Windows Type 2			11.79	x	1/[1/(1)+ 0.04]	=	11.34			(27)
Windows Type 3			1.59	x	1/[1/(1)+ 0.04]	=	1.53			(27)
Windows Type 4			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 5			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 6			16.35	x	1/[1/(1)+ 0.04]	=	15.72			(27)
Windows Type 7			1.57	x	1/[1/(1)+ 0.04]	=	1.51			(27)
Walls	55.49	46.1	9.39	x	0.24	=	2.25			(29)
Total area of elements, m²			55.49							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			44.87	x	0	=	0			(32)
Party floor			121.32							(32a)
Party ceiling			121.32							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.58 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25283.07 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 4.09 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.4	38.88	38.36	35.74	35.22	32.6	32.6	32.07	33.64	35.22	36.26	37.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.07	89.55	89.02	86.41	85.88	83.26	83.26	82.74	84.31	85.88	86.93	87.98	

Average = Sum(39)$_{1...12}$ /12= 86.27 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.69	0.69	0.68	0.69	0.71	0.72	0.73	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.61 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Output from water heater (annual)$_{1...12}$ — 1962.51 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.46	70.18	74.05	66.85	65.86	59.34	57.46	62.4	62.09	69.3	72.68	77.7	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	63.95	56.8	46.19	34.97	26.14	22.07	23.85	31	41.6	52.82	61.65	65.73	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	428.24	432.69	421.49	397.65	367.55	339.27	320.38	315.93	327.13	350.97	381.06	409.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	106.8	104.43	99.52	92.85	88.52	82.42	77.23	83.88	86.24	93.14	100.94	104.44	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	711.43	706.36	679.65	637.91	594.66	556.2	533.9	543.25	567.41	609.38	656.1	691.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
East 0.9x	0.77	x	16.35	x	19.64	x	0.4	x	0.8	=	71.21	(76)
East 0.9x	0.77	x	16.35	x	38.42	x	0.4	x	0.8	=	139.3	(76)
East 0.9x	0.77	x	16.35	x	63.27	x	0.4	x	0.8	=	229.41	(76)

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East	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	0.8	=	334.59	(76)
East	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	0.8	=	410.05	(76)
East	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	0.8	=	419.76	(76)
East	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	0.8	=	399.63	(76)
East	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	0.8	=	343.27	(76)
East	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	0.8	=	266.82	(76)
East	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	0.8	=	165.3	(76)
East	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	0.8	=	88.79	(76)
East	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	0.8	=	58.56	(76)
Southeast	0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast	0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast	0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)
Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)

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South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	233.43	424.61	645.3	895.38	1081.67	1106.18	1053.19	910.8	732.17	487.34	284.69	196.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	944.86	1130.97	1324.94	1533.29	1676.33	1662.38	1587.09	1454.05	1299.59	1096.72	940.79	888.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.86	0.77	0.62	0.46	0.32	0.23	0.26	0.43	0.7	0.87	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.78	20.32	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.31	20.31	20.33	20.33	20.35	20.35	20.36	20.35	20.33	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.85	0.75	0.59	0.43	0.29	0.2	0.22	0.4	0.67	0.85	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.84	19.25	19.71	20.12	20.28	20.34	20.35	20.35	20.32	20.07	19.44	18.8	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.84	0.74	0.6	0.44	0.3	0.21	0.24	0.41	0.67	0.84	0.91	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	844.34	945.75	985.21	913.63	741	501.55	339.07	353.02	538.27	736.67	792.25	805.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1358.7	1328.54	1213.65	1000.63	766.21	505.89	339.96	354.44	552.33	844.33	1112.16	1332.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1594.2 (98)

Space heating requirement in kWh/m²/year 13.14 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	782.68	616.15	628.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	763.57	607.91	616.98	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1849.14	1764.9	1607.82	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	781.61	860.8	737.18	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 2379.6 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	170	187.23	160.34	0	0	0	0	

Total = Sum(107)$_{6...8}$ = 517.57 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.27 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	225.11	151.31	99.97	36.85	11.03	0	0	0	0	47.12	135.49	230.88	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 937.77 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59

Efficiency of water heater — 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Total = Sum(219a)$_{1...12}$ = 1962.51 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	28.62	31.52	26.99	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 87.13 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.77	
Water heating fuel used		1962.51	
Space cooling fuel used		87.13	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	369.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	369.66	(231)
Electricity for lighting		451.74	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3808.8	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	123.69	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	258.85	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.49	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	48.76	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.58	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				502.38	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.3	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.7	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1018.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1505.24	(265)
Space cooling	(221)	x	0.519	=	45.22	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	191.85	(267)
Electricity for lighting	(232)	x	0.519	=	234.45	(268)
Total CO2, kg/year		sum of (265)…(271) =			1976.77	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.29	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2878.94	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6024.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8903.83	(265)
Space cooling	(221)	x	3.07	=	267.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	1134.84	(267)
Electricity for lighting	(232)	x	0	=	1386.84	(268)
'Total Primary Energy		sum of (265)…(271) =			11693.01	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			96.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32	(1a) x	2.7	(2a) =	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.37	x1/[1/(1.5)+ 0.04] =	9.01			(27)
Windows Type 2			7.76	x1/[1/(1.5)+ 0.04] =	10.98			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 5			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 6			10.76	x1/[1/(1.5)+ 0.04] =	15.23			(27)
Windows Type 7			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Walls	55.49	30.33	25.16	x 0.18 =	4.53			(29)
Total area of elements, m²			55.49					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			44.87	x 0 =	0			(32)
Party floor			121.32					(32a)
Party ceiling			121.32					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.45 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25503.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.33 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.36	61.07	60.79	59.49	59.24	58.1	58.1	57.89	58.54	59.24	59.74	60.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.68	112.4	112.12	110.82	110.57	109.43	109.43	109.22	109.87	110.57	111.07	111.58	

Average = Sum(39)$_{1...12}$ /12= 110.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.92	0.91	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	

Output from water heater (annual)$_{1...12}$	2199.71	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.57	84.73	90.16	82.45	81.97	74.94	73.58	78.52	77.69	85.42	88.28	93.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.58	22.72	18.48	13.99	10.46	8.83	9.54	12.4	16.64	21.13	24.66	26.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	286.92	289.9	282.4	266.42	246.26	227.31	214.65	211.67	219.18	235.15	255.31	274.26	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	128.46	126.09	121.19	114.51	110.18	104.08	98.9	105.54	107.9	114.81	122.6	126.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	509.98	507.74	491.08	463.95	435.92	409.24	392.11	398.64	412.74	440.11	471.6	495.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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TER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)
North	0.9x	0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
Northeast	0.9x	0.77	x	7.76	x	11.28	x	0.63	x	0.7	=	26.76	(75)
Northeast	0.9x	0.77	x	7.76	x	22.97	x	0.63	x	0.7	=	54.47	(75)
Northeast	0.9x	0.77	x	7.76	x	41.38	x	0.63	x	0.7	=	98.13	(75)
Northeast	0.9x	0.77	x	7.76	x	67.96	x	0.63	x	0.7	=	161.16	(75)
Northeast	0.9x	0.77	x	7.76	x	91.35	x	0.63	x	0.7	=	216.63	(75)
Northeast	0.9x	0.77	x	7.76	x	97.38	x	0.63	x	0.7	=	230.95	(75)
Northeast	0.9x	0.77	x	7.76	x	91.1	x	0.63	x	0.7	=	216.05	(75)
Northeast	0.9x	0.77	x	7.76	x	72.63	x	0.63	x	0.7	=	172.24	(75)
Northeast	0.9x	0.77	x	7.76	x	50.42	x	0.63	x	0.7	=	119.58	(75)
Northeast	0.9x	0.77	x	7.76	x	28.07	x	0.63	x	0.7	=	66.56	(75)
Northeast	0.9x	0.77	x	7.76	x	14.2	x	0.63	x	0.7	=	33.67	(75)
Northeast	0.9x	0.77	x	7.76	x	9.21	x	0.63	x	0.7	=	21.85	(75)
East	0.9x	0.77	x	10.76	x	19.64	x	0.63	x	0.7	=	64.58	(76)
East	0.9x	0.77	x	10.76	x	38.42	x	0.63	x	0.7	=	126.34	(76)
East	0.9x	0.77	x	10.76	x	63.27	x	0.63	x	0.7	=	208.07	(76)

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East	0.9x	0.77	x	10.76	x	92.28	x	0.63	x	0.7	=	303.45	(76)
East	0.9x	0.77	x	10.76	x	113.09	x	0.63	x	0.7	=	371.89	(76)
East	0.9x	0.77	x	10.76	x	115.77	x	0.63	x	0.7	=	380.7	(76)
East	0.9x	0.77	x	10.76	x	110.22	x	0.63	x	0.7	=	362.44	(76)
East	0.9x	0.77	x	10.76	x	94.68	x	0.63	x	0.7	=	311.33	(76)
East	0.9x	0.77	x	10.76	x	73.59	x	0.63	x	0.7	=	241.99	(76)
East	0.9x	0.77	x	10.76	x	45.59	x	0.63	x	0.7	=	149.92	(76)
East	0.9x	0.77	x	10.76	x	24.49	x	0.63	x	0.7	=	80.53	(76)
East	0.9x	0.77	x	10.76	x	16.15	x	0.63	x	0.7	=	53.11	(76)
Southeast	0.9x	0.77	x	6.37	x	36.79	x	0.63	x	0.7	=	71.63	(77)
Southeast	0.9x	0.77	x	6.37	x	62.67	x	0.63	x	0.7	=	122.01	(77)
Southeast	0.9x	0.77	x	6.37	x	85.75	x	0.63	x	0.7	=	166.94	(77)
Southeast	0.9x	0.77	x	6.37	x	106.25	x	0.63	x	0.7	=	206.85	(77)
Southeast	0.9x	0.77	x	6.37	x	119.01	x	0.63	x	0.7	=	231.68	(77)
Southeast	0.9x	0.77	x	6.37	x	118.15	x	0.63	x	0.7	=	230.01	(77)
Southeast	0.9x	0.77	x	6.37	x	113.91	x	0.63	x	0.7	=	221.75	(77)
Southeast	0.9x	0.77	x	6.37	x	104.39	x	0.63	x	0.7	=	203.22	(77)
Southeast	0.9x	0.77	x	6.37	x	92.85	x	0.63	x	0.7	=	180.76	(77)
Southeast	0.9x	0.77	x	6.37	x	69.27	x	0.63	x	0.7	=	134.85	(77)
Southeast	0.9x	0.77	x	6.37	x	44.07	x	0.63	x	0.7	=	85.79	(77)
Southeast	0.9x	0.77	x	6.37	x	31.49	x	0.63	x	0.7	=	61.3	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)

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South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	210.78	383.53	583.11	809.37	977.93	1000.14	952.21	823.38	661.72	440.26	257.09	177.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	720.77	891.27	1074.19	1273.32	1413.85	1409.38	1344.32	1222.01	1074.46	880.37	728.7	672.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.7	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.25	20.53	20.82	20.96	21	21	21	20.98	20.74	20.34	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.61	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.16	19.56	19.96	20.13	20.16	20.17	20.17	20.15	19.87	19.29	18.84	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	718.4	881.41	1031.31	1093.72	944.32	652.34	436.71	457.36	690.72	817.73	722.26	671.48	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1711.46	1666.06	1519.97	1274.59	979.16	655.56	437.01	458.05	711.1	1074.5	1413.77	1701.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3241.14 (98)

Space heating requirement in kWh/m²/year 26.72 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	790.2	563.94	388.84	139.28	27.72	0	0	0	0	204.32	532.5	819.67	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3466.46 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	
Efficiency of water heater													79.8 (216)
(217)m=	87.83	87.38	86.38	83.97	81.03	79.8	79.8	79.8	79.8	84.88	87.18	87.95	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	247.08	218.84	232.39	214.14	217.34	197.02	189.05	207.67	207.38	219.68	226.34	240.76	

Total = Sum(219a)$_{1...12}$ = 2617.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3466.46
Water heating fuel used		2617.68
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		451.74 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6610.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	748.76	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.42	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1314.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	234.45	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.55	(272)

TER = 19.04 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 37 Flat 37 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	432.38	**(P1)**
Transmission heat loss coefficient:	50.7	
Summer heat loss coefficient:	483.05	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
East (E)	0	1
North (N)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
East (E)	0.9 x	16.35	108.47	0.4	0.8	0.9	459.68	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1211.46	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	556.2	533.9	543.25	
Total summer gains	1868.53	1745.36	1573.92	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	3.87	3.61	3.26	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.87	21.31	20.86	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:32:26

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 236.67m²
Site Reference : P1785 St Michaels
Plot Reference: Level 37 Flat 37 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	14.49 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	33.34m²
Windows facing: South West	30.67m²
Windows facing: South	22.53m²
Windows facing: South	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 37 Flat 37 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	236.67 m²	2.7 m

Living area:	98.45 m² (fraction 0.416)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	33.34	1
SW	16mm or more	0.8	0.4	1	30.67	1
S	16mm or more	1	0.4	1	22.53	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South West	0	0
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	114.87	91.39	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	391.77						N/A
Party Elements							
PARTY WALLS	35.74						N/A
WALLS TO CORRIDOR	28.53						N/A
PARTY CEILING	236.67						N/A

SAP Input

PARTY FLOOR	236.67	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0843

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.02	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.58	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 205.31 (fraction 0.867)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			30.67	x 1/[1/(1)+ 0.04]		=	29.49			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	114.87	91.39	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			114.87							(31)
Party wall			35.74	x	0	=	0			(32)
Party wall			28.53	x	0	=	0			(32)
Party floor			236.67							(32a)
Party ceiling			236.67							(32b)
Internal wall **			391.77							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 47740.65 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.69 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.2 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	76.87	75.85	74.83	69.72	68.7	63.59	63.59	62.57	65.63	68.7	70.74	72.78	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	180.07	179.05	178.02	172.92	171.9	166.79	166.79	165.77	168.83	171.9	173.94	175.98	

Average = Sum(39)$_{1...12}$ /12= 172.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.76	0.76	0.75	0.73	0.73	0.7	0.7	0.7	0.71	0.73	0.73	0.74	

Average = Sum(40)$_{1...12}$ /12= 0.73 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	

Output from water heater (annual)$_{1...12}$ — 2030.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.79	72.22	76.15	68.69	67.62	60.86	58.87	64.02	63.73	71.21	74.76	79.97	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	90.2	80.11	65.15	49.32	36.87	31.13	33.63	43.72	58.68	74.51	86.96	92.7	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	604.01	610.28	594.48	560.86	518.41	478.52	451.87	445.6	461.4	495.02	537.47	577.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	109.93	107.47	102.36	95.4	90.89	84.53	79.13	86.05	88.51	95.71	103.84	107.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	921.48	915.2	879.33	822.92	763.51	711.52	681.97	692.71	725.93	782.58	845.6	894.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	22.53	x	46.75	x	0.4	x	1	=	291.98	(78)
South	0.9x	0.77	x	4.85	x	46.75	x	0.4	x	0.7	=	44	(78)
South	0.9x	0.77	x	22.53	x	76.57	x	0.4	x	1	=	478.19	(78)
South	0.9x	0.77	x	4.85	x	76.57	x	0.4	x	0.7	=	72.06	(78)
South	0.9x	0.77	x	22.53	x	97.53	x	0.4	x	1	=	609.13	(78)
South	0.9x	0.77	x	4.85	x	97.53	x	0.4	x	0.7	=	91.79	(78)
South	0.9x	0.77	x	22.53	x	110.23	x	0.4	x	1	=	688.45	(78)
South	0.9x	0.77	x	4.85	x	110.23	x	0.4	x	0.7	=	103.74	(78)
South	0.9x	0.77	x	22.53	x	114.87	x	0.4	x	1	=	717.41	(78)
South	0.9x	0.77	x	4.85	x	114.87	x	0.4	x	0.7	=	108.1	(78)
South	0.9x	0.77	x	22.53	x	110.55	x	0.4	x	1	=	690.41	(78)
South	0.9x	0.77	x	4.85	x	110.55	x	0.4	x	0.7	=	104.04	(78)
South	0.9x	0.77	x	22.53	x	108.01	x	0.4	x	1	=	674.57	(78)
South	0.9x	0.77	x	4.85	x	108.01	x	0.4	x	0.7	=	101.65	(78)
South	0.9x	0.77	x	22.53	x	104.89	x	0.4	x	1	=	655.1	(78)
South	0.9x	0.77	x	4.85	x	104.89	x	0.4	x	0.7	=	98.72	(78)
South	0.9x	0.77	x	22.53	x	101.89	x	0.4	x	1	=	636.31	(78)
South	0.9x	0.77	x	4.85	x	101.89	x	0.4	x	0.7	=	95.88	(78)
South	0.9x	0.77	x	22.53	x	82.59	x	0.4	x	1	=	515.77	(78)
South	0.9x	0.77	x	4.85	x	82.59	x	0.4	x	0.7	=	77.72	(78)
South	0.9x	0.77	x	22.53	x	55.42	x	0.4	x	1	=	346.1	(78)
South	0.9x	0.77	x	4.85	x	55.42	x	0.4	x	0.7	=	52.15	(78)
South	0.9x	0.77	x	22.53	x	40.4	x	0.4	x	1	=	252.3	(78)
South	0.9x	0.77	x	4.85	x	40.4	x	0.4	x	0.7	=	38.02	(78)
Southwest	0.9x	0.77	x	33.34	x	36.79		0.4	x	0.8	=	272.03	(79)
Southwest	0.9x	0.77	x	30.67	x	36.79		0.4	x	0.8	=	250.25	(79)
Southwest	0.9x	0.77	x	33.34	x	62.67		0.4	x	0.8	=	463.38	(79)
Southwest	0.9x	0.77	x	30.67	x	62.67		0.4	x	0.8	=	426.27	(79)
Southwest	0.9x	0.77	x	33.34	x	85.75		0.4	x	0.8	=	634.01	(79)
Southwest	0.9x	0.77	x	30.67	x	85.75		0.4	x	0.8	=	583.24	(79)
Southwest	0.9x	0.77	x	33.34	x	106.25		0.4	x	0.8	=	785.57	(79)
Southwest	0.9x	0.77	x	30.67	x	106.25		0.4	x	0.8	=	722.66	(79)
Southwest	0.9x	0.77	x	33.34	x	119.01		0.4	x	0.8	=	879.9	(79)
Southwest	0.9x	0.77	x	30.67	x	119.01		0.4	x	0.8	=	809.44	(79)
Southwest	0.9x	0.77	x	33.34	x	118.15		0.4	x	0.8	=	873.54	(79)
Southwest	0.9x	0.77	x	30.67	x	118.15		0.4	x	0.8	=	803.58	(79)
Southwest	0.9x	0.77	x	33.34	x	113.91		0.4	x	0.8	=	842.19	(79)
Southwest	0.9x	0.77	x	30.67	x	113.91		0.4	x	0.8	=	774.74	(79)
Southwest	0.9x	0.77	x	33.34	x	104.39		0.4	x	0.8	=	771.81	(79)
Southwest	0.9x	0.77	x	30.67	x	104.39		0.4	x	0.8	=	710	(79)
Southwest	0.9x	0.77	x	33.34	x	92.85		0.4	x	0.8	=	686.5	(79)

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Southwest 0.9x	0.77	x	30.67	x	92.85	0.4	x	0.8	=	631.52	(79)
Southwest 0.9x	0.77	x	33.34	x	69.27	0.4	x	0.8	=	512.13	(79)
Southwest 0.9x	0.77	x	30.67	x	69.27	0.4	x	0.8	=	471.11	(79)
Southwest 0.9x	0.77	x	33.34	x	44.07	0.4	x	0.8	=	325.83	(79)
Southwest 0.9x	0.77	x	30.67	x	44.07	0.4	x	0.8	=	299.74	(79)
Southwest 0.9x	0.77	x	33.34	x	31.49	0.4	x	0.8	=	232.8	(79)
Southwest 0.9x	0.77	x	30.67	x	31.49	0.4	x	0.8	=	214.16	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	858.26	1439.89	1918.16	2300.42	2514.85	2471.56	2393.14	2235.62	2050.21	1576.74	1023.83	737.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	1779.74	2355.09	2797.49	3123.34	3278.36	3183.08	3075.12	2928.33	2776.14	2359.31	1869.43	1632.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.85	0.74	0.61	0.47	0.33	0.24	0.26	0.41	0.66	0.87	0.94	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.81	20.22	20.56	20.82	20.94	20.99	21	21	20.97	20.8	20.3	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.29	20.29	20.29	20.31	20.32	20.34	20.34	20.34	20.33	20.32	20.31	20.3	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.92	0.83	0.72	0.58	0.44	0.3	0.2	0.22	0.37	0.63	0.85	0.93	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.69	19.27	19.74	20.1	20.25	20.33	20.33	20.34	20.3	20.08	19.4	18.61	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.9	0.82	0.72	0.58	0.45	0.31	0.22	0.24	0.39	0.63	0.84	0.92	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	1603.99	1925.85	2003.79	1820.6	1464.6	990.53	666.8	695.28	1070.65	1496.7	1566.57	1498.19	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	2675.7	2643.94	2417.77	1988.88	1519.44	1000.9	668.87	698.15	1094.29	1681.42	2204.1	2619.78	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3180.79	(98)
Space heating requirement in kWh/m²/year	13.44	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1567.81	1234.23	1259.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1523.49	1215.53	1236.37	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3600.36	3479.15	3305.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1495.34	1684.14	1539.64	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	4719.12	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.87	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	324.3	365.25	333.91	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	1023.45	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.32	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	469.03	283.86	181.18	71.27	24	0	0	0	0	80.84	270.01	490.86	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1871.06	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Total = Sum(219a)$_{1...12}$ = 2030.26 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	54.6	61.49	56.21	0	0	0	0

Total = Sum(221)$_{6...8}$ = 172.3 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1871.06	
Water heating fuel used		2030.26	
Space cooling fuel used		172.3	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	721.12		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	721.12	(231)
Electricity for lighting		637.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5431.89	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	246.79	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	267.79	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	22.73	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	95.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	84.04	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				716.47	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.07	(257)
SAP rating (Section 12)		85.1	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	971.08	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1053.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2024.78	(265)
Space cooling	(221)	x	0.519	=	89.42	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	374.26	(267)
Electricity for lighting	(232)	x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =				2819.15	(272)
CO2 emissions per m²	(272) ÷ (4) =				11.91	(273)
EI rating (section 14)					87	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	5744.14	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6232.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				11977.05	(265)
Space cooling	(221)	x	3.07	=	528.96	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	2213.84	(267)
Electricity for lighting	(232)	x	0	=	1956.05	(268)
'Total Primary Energy	sum of (265)…(271) =				16675.9	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				70.46	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.06 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.31 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.24 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.31	0.3	0.3	0.27	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.58	x1/[1/(1.5)+ 0.04] =	30.54			(27)
Windows Type 2			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 3			14.59	x1/[1/(1.5)+ 0.04] =	20.65			(27)
Windows Type 4			3.14	x1/[1/(1.5)+ 0.04] =	4.44			(27)
Walls	114.87	59.17	55.7	x 0.18 =	10.03			(29)
Total area of elements, m²			114.87					(31)
Party wall			35.74	x 0 =	0			(32)
Party wall			28.53	x 0 =	0			(32)
Party floor			236.67					(32a)
Party ceiling			236.67					(32b)
Internal wall **			391.77					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 48191.73 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.47 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.22 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	115.5	115.11	114.72	112.92	112.59	111.02	111.02	110.73	111.62	112.59	113.27	113.98	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	218.72	218.33	217.95	216.15	215.81	214.24	214.24	213.95	214.85	215.81	216.49	217.2	

Average = Sum(39)$_{1...12}$ /12= 216.15 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.9	0.91	0.91	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	

Output from water heater (annual)$_{1...12}$ — 2267.46 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.91	86.78	92.27	84.29	83.74	76.46	74.99	80.14	79.32	87.32	90.36	96.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	36.08	32.04	26.06	19.73	14.75	12.45	13.45	17.49	23.47	29.8	34.78	37.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	404.69	408.89	398.3	375.78	347.34	320.61	302.75	298.55	309.14	331.66	360.1	386.83	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	131.6	129.13	124.02	117.07	112.55	106.19	100.79	107.71	110.17	117.37	125.5	129.14	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	644.11	641.81	620.13	584.31	546.38	511	488.74	495.5	514.53	550.58	592.13	624.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	14.59	x	46.75	x	0.63	x	0.7	=	208.46	(78)
South	0.9x	0.77	x	3.14	x	46.75	x	0.63	x	0.7	=	44.86	(78)
South	0.9x	0.77	x	14.59	x	76.57	x	0.63	x	0.7	=	341.41	(78)
South	0.9x	0.77	x	3.14	x	76.57	x	0.63	x	0.7	=	73.48	(78)
South	0.9x	0.77	x	14.59	x	97.53	x	0.63	x	0.7	=	434.89	(78)
South	0.9x	0.77	x	3.14	x	97.53	x	0.63	x	0.7	=	93.6	(78)
South	0.9x	0.77	x	14.59	x	110.23	x	0.63	x	0.7	=	491.52	(78)
South	0.9x	0.77	x	3.14	x	110.23	x	0.63	x	0.7	=	105.78	(78)
South	0.9x	0.77	x	14.59	x	114.87	x	0.63	x	0.7	=	512.2	(78)
South	0.9x	0.77	x	3.14	x	114.87	x	0.63	x	0.7	=	110.23	(78)
South	0.9x	0.77	x	14.59	x	110.55	x	0.63	x	0.7	=	492.92	(78)
South	0.9x	0.77	x	3.14	x	110.55	x	0.63	x	0.7	=	106.08	(78)
South	0.9x	0.77	x	14.59	x	108.01	x	0.63	x	0.7	=	481.61	(78)
South	0.9x	0.77	x	3.14	x	108.01	x	0.63	x	0.7	=	103.65	(78)
South	0.9x	0.77	x	14.59	x	104.89	x	0.63	x	0.7	=	467.71	(78)
South	0.9x	0.77	x	3.14	x	104.89	x	0.63	x	0.7	=	100.66	(78)
South	0.9x	0.77	x	14.59	x	101.89	x	0.63	x	0.7	=	454.3	(78)
South	0.9x	0.77	x	3.14	x	101.89	x	0.63	x	0.7	=	97.77	(78)
South	0.9x	0.77	x	14.59	x	82.59	x	0.63	x	0.7	=	368.24	(78)
South	0.9x	0.77	x	3.14	x	82.59	x	0.63	x	0.7	=	79.25	(78)
South	0.9x	0.77	x	14.59	x	55.42	x	0.63	x	0.7	=	247.1	(78)
South	0.9x	0.77	x	3.14	x	55.42	x	0.63	x	0.7	=	53.18	(78)
South	0.9x	0.77	x	14.59	x	40.4	x	0.63	x	0.7	=	180.13	(78)
South	0.9x	0.77	x	3.14	x	40.4	x	0.63	x	0.7	=	38.77	(78)
Southwest	0.9x	0.77	x	21.58	x	36.79		0.63	x	0.7	=	242.66	(79)
Southwest	0.9x	0.77	x	19.86	x	36.79		0.63	x	0.7	=	223.32	(79)
Southwest	0.9x	0.77	x	21.58	x	62.67		0.63	x	0.7	=	413.34	(79)
Southwest	0.9x	0.77	x	19.86	x	62.67		0.63	x	0.7	=	380.4	(79)
Southwest	0.9x	0.77	x	21.58	x	85.75		0.63	x	0.7	=	565.55	(79)
Southwest	0.9x	0.77	x	19.86	x	85.75		0.63	x	0.7	=	520.47	(79)
Southwest	0.9x	0.77	x	21.58	x	106.25		0.63	x	0.7	=	700.74	(79)
Southwest	0.9x	0.77	x	19.86	x	106.25		0.63	x	0.7	=	644.89	(79)
Southwest	0.9x	0.77	x	21.58	x	119.01		0.63	x	0.7	=	784.89	(79)
Southwest	0.9x	0.77	x	19.86	x	119.01		0.63	x	0.7	=	722.33	(79)
Southwest	0.9x	0.77	x	21.58	x	118.15		0.63	x	0.7	=	779.21	(79)
Southwest	0.9x	0.77	x	19.86	x	118.15		0.63	x	0.7	=	717.11	(79)
Southwest	0.9x	0.77	x	21.58	x	113.91		0.63	x	0.7	=	751.25	(79)
Southwest	0.9x	0.77	x	19.86	x	113.91		0.63	x	0.7	=	691.37	(79)
Southwest	0.9x	0.77	x	21.58	x	104.39		0.63	x	0.7	=	688.47	(79)
Southwest	0.9x	0.77	x	19.86	x	104.39		0.63	x	0.7	=	633.6	(79)
Southwest	0.9x	0.77	x	21.58	x	92.85		0.63	x	0.7	=	612.37	(79)

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Southwest	0.9x	0.77	x	19.86	x	92.85		0.63	x	0.7	=	563.56	(79)
Southwest	0.9x	0.77	x	21.58	x	69.27		0.63	x	0.7	=	456.83	(79)
Southwest	0.9x	0.77	x	19.86	x	69.27		0.63	x	0.7	=	420.42	(79)
Southwest	0.9x	0.77	x	21.58	x	44.07		0.63	x	0.7	=	290.65	(79)
Southwest	0.9x	0.77	x	19.86	x	44.07		0.63	x	0.7	=	267.48	(79)
Southwest	0.9x	0.77	x	21.58	x	31.49		0.63	x	0.7	=	207.67	(79)
Southwest	0.9x	0.77	x	19.86	x	31.49		0.63	x	0.7	=	191.11	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	719.31	1208.62	1614.51	1942.94	2129.65	2095.33	2027.88	1890.44	1728	1324.74	858.41	617.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1363.41	1850.43	2234.64	2527.26	2676.03	2606.33	2516.62	2385.94	2242.53	1875.32	1450.54	1242.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.71	0.52	0.37	0.41	0.64	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.3	20.58	20.83	20.96	20.99	21	21	20.98	20.79	20.35	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.95	0.84	0.66	0.46	0.3	0.34	0.57	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.24	19.63	19.97	20.12	20.16	20.16	20.16	20.15	19.93	19.31	18.8	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.98	0.95	0.85	0.68	0.48	0.33	0.37	0.6	0.9	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1359.42	1822.08	2115.87	2144.49	1818.6	1257.64	837.2	878.35	1346.37	1689.15	1435.85	1240.29	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3294.33	3227	2947.92	2470.15	1892.44	1265.55	837.87	879.59	1374.04	2089.87	2737.27	3280.14	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6044.94	(98)
Space heating requirement in kWh/m²/year	25.54	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	1539.65	1009.74	662.08	250.78	58.76	0	0	0	0	318.86	1002.16	1623.15	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 6465.18 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	88.89	88.45	87.56	85.44	82.06	79.8	79.8	79.8	79.8	85.98	88.38	89

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	252.02	223.15	236.5	216.92	221.09	202.75	194.36	213.77	213.55	223.54	230.35	245.56

Total = Sum(219a)$_{1...12}$ = 2673.55 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		6465.18
Water heating fuel used		2673.55
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		637.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9850.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	1396.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	577.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1973.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			2343.57	(272)

TER = 14.49 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 37 Flat 37 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	843.49	**(P1)**
Transmission heat loss coefficient:	103.2	
Summer heat loss coefficient:	946.69	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SE)	0	1
South West (SW)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SE)	1	0.9	1	0.9	**(P8)**
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SE)	0.9 x	33.34	112.1	0.4	0.8	0.9	968.75	
South West (SW)	0.9 x	30.67	112.1	0.4	0.8	0.9	891.17	
South (S)	0.9 x	22.53	106.3	0.4	1	0.9	775.94	
South (S GLAZED DOOR)	0.9 x	4.85	106.3	0.4	0.7	0.9	116.93	
						Total	2752.78	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	711.52	681.97	692.71	
Total summer gains	3643.69	3434.75	3222.56	**(P5)**
Summer gain/loss ratio	3.85	3.63	3.4	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.85	21.33	21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:32:16

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 122.24m²
Site Reference : P1785 St Michaels
Plot Reference: Level 37 Flat 37 04
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.89 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.15 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	37.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.8 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.90 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: West	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 37 Flat 37 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	122.24 m²	2.7 m

Living area:	63.24 m² (fraction 0.517)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
W	16mm or more	1	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	52.72	46.1	6.62	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	45.2						N/A
PARTY CEILING	122.24						N/A
PARTY FLOOR	122.24						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0748

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	30.48	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.35	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	61.15	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 106.48 (fraction 0.871)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24	(1a) x	2.7	(2a) =	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x 1/[1/(1)+ 0.04]		=	9.31			(27)
Windows Type 2			11.79	x 1/[1/(1)+ 0.04]		=	11.34			(27)
Windows Type 3			1.59	x 1/[1/(1)+ 0.04]		=	1.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 5			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 6			16.35	x 1/[1/(1)+ 0.04]		=	15.72			(27)
Windows Type 7			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Walls	52.72	46.1	6.62	x	0.24	=	1.59			(29)
Total area of elements, m²			52.72							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			45.2	x	0	=	0			(32)
Party floor			122.24							(32a)
Party ceiling			122.24							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25416.49 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 3.94 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 49.86 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.7	39.18	38.65	36.01	35.48	32.84	32.84	32.32	33.9	35.48	36.54	37.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.56	89.03	88.51	85.87	85.34	82.7	82.7	82.18	83.76	85.34	86.4	87.45	

Average = Sum(39)$_{1...12}$ /12= | 85.74 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.69	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= | 0.7 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.87 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 102.4 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = | 1228.8 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = | 1611.15 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 190 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 1.61 | (48)

Temperature factor from Table 2b | 0.6 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.97 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Output from water heater (annual)$_{1...12}$ — 1963.74 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.5	70.22	74.08	66.89	65.89	59.37	57.49	62.43	62.12	69.33	72.72	77.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	64.21	57.03	46.38	35.11	26.25	22.16	23.94	31.12	41.77	53.04	61.91	66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	430	434.46	423.22	399.28	369.06	340.67	321.69	317.23	328.47	352.41	382.63	411.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	106.85	104.49	99.57	92.9	88.56	82.46	77.27	83.92	86.28	93.19	100.99	104.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	713.6	708.52	681.71	639.83	596.41	557.81	535.44	544.8	569.06	611.18	658.06	694.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
Southeast 0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast 0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast 0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)

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Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	16.35	x	19.64	x	0.4	x	1	=	89.01	(80)
West	0.9x	0.77	x	16.35	x	38.42	x	0.4	x	1	=	174.13	(80)
West	0.9x	0.77	x	16.35	x	63.27	x	0.4	x	1	=	286.77	(80)
West	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	1	=	418.23	(80)
West	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	1	=	512.56	(80)
West	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	1	=	524.7	(80)
West	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	1	=	499.53	(80)
West	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	1	=	429.09	(80)

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West	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	1	=	333.52	(80)
West	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	1	=	206.62	(80)
West	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	1	=	110.99	(80)
West	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	1	=	73.2	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	251.24	459.43	702.65	979.02	1184.18	1211.12	1153.1	996.62	798.88	528.66	306.89	211.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.83	1167.95	1384.36	1618.85	1780.59	1768.93	1688.54	1541.42	1367.94	1139.84	964.95	905.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.85	0.75	0.59	0.43	0.3	0.21	0.24	0.41	0.68	0.86	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.25	20.58	20.85	20.96	20.99	21	21	20.98	20.8	20.36	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.33	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.84	0.73	0.56	0.4	0.27	0.18	0.21	0.38	0.65	0.84	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.33	19.79	20.16	20.3	20.35	20.36	20.36	20.33	20.11	19.5	18.86	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.83	0.73	0.57	0.42	0.28	0.2	0.23	0.39	0.65	0.83	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	858.27	965.6	1005.23	924.06	742.83	499.95	337.63	351.58	538.38	745.71	805.49	817.39	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1356.33	1327.07	1212.24	997.74	762.95	503.24	338.29	352.65	549.79	842.04	1109.9	1329.71	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1507.51 (98)

Space heating requirement in kWh/m²/year 12.33 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	777.41	612	624.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	762.73	605.78	615.42	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1973.41	1883.21	1709.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	871.69	950.41	814.13	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 2636.23 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	189.83	206.97	177.29	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ = 574.09 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.7 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	217.97	142.88	90.6	31.21	8.81	0	0	0	0	42.16	128.93	224.22	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 886.77 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72

Efficiency of water heater 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Total = Sum(219a)$_{1...12}$ = 1963.74 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	31.96	34.84	29.85	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 96.65 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		886.77	
Water heating fuel used		1963.74	
Space cooling fuel used		96.65	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	372.46		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		372.46	(231)
Electricity for lighting		453.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3773.21	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	116.96	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	259.02	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	12.75	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	49.13	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.83	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost (245)...(247) + (250)…(254) =					497.69	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.25	(257)
SAP rating (Section 12)		82.56	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	460.23	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1019.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1479.41	(265)
Space cooling	(221) x		0.519	=	50.16	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	193.31	(267)
Electricity for lighting	(232) x		0.519	=	235.42	(268)
Total CO2, kg/year		sum of (265)…(271) =			1958.3	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.02	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2722.38	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6028.67	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8751.06	(265)
Space cooling	(221) x		3.07	=	296.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	1143.45	(267)
Electricity for lighting	(232) x		0	=	1392.54	(268)
'Total Primary Energy		sum of (265)…(271) =			11583.75	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			94.76	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 37 Flat 37 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24	(1a) x	2.7	(2a) =	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.42	x1/[1/(1.5)+ 0.04] =	9.08			(27)
Windows Type 2			7.82	x1/[1/(1.5)+ 0.04] =	11.07			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 5			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 6			10.84	x1/[1/(1.5)+ 0.04] =	15.34			(27)
Windows Type 7			1.04	x1/[1/(1.5)+ 0.04] =	1.47			(27)
Walls	52.72	30.57	22.15	x 0.18 =	3.99			(29)
Total area of elements, m²			52.72					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			45.2	x 0 =	0			(32)
Party floor			122.24					(32a)
Party ceiling			122.24					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25633.91 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.78	61.5	61.22	59.91	59.67	58.53	58.53	58.31	58.96	59.67	60.16	60.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.77	112.48	112.2	110.89	110.65	109.51	109.51	109.3	109.95	110.65	111.14	111.66	

Average = Sum(39)$_{1...12}$ /12= 110.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.91	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.4 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = 1228.8 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = 1611.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Output from water heater (annual)$_{1...12}$ 2200.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.61	84.77	90.2	82.48	82.01	74.97	73.6	78.55	77.72	85.45	88.31	93.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.68	22.81	18.55	14.05	10.5	8.86	9.58	12.45	16.71	21.22	24.76	26.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	288.1	291.09	283.56	267.52	247.27	228.25	215.53	212.54	220.08	236.12	256.36	275.39	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	128.51	126.15	121.24	114.56	110.22	104.12	98.93	105.58	107.94	114.85	122.66	126.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	511.37	509.13	492.42	465.2	437.07	410.3	393.12	399.65	413.8	441.26	472.86	497.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North 0.9x	0.77	x	1.04	x	10.63	x	0.63	x	0.7	=	3.38	(74)
North 0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North 0.9x	0.77	x	1.04	x	20.32	x	0.63	x	0.7	=	6.46	(74)
North 0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North 0.9x	0.77	x	1.04	x	34.53	x	0.63	x	0.7	=	10.98	(74)
North 0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North 0.9x	0.77	x	1.04	x	55.46	x	0.63	x	0.7	=	17.63	(74)
North 0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North 0.9x	0.77	x	1.04	x	74.72	x	0.63	x	0.7	=	23.75	(74)
North 0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North 0.9x	0.77	x	1.04	x	79.99	x	0.63	x	0.7	=	25.42	(74)
North 0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North 0.9x	0.77	x	1.04	x	74.68	x	0.63	x	0.7	=	23.74	(74)
North 0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North 0.9x	0.77	x	1.04	x	59.25	x	0.63	x	0.7	=	18.83	(74)
North 0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North 0.9x	0.77	x	1.04	x	41.52	x	0.63	x	0.7	=	13.2	(74)
North 0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North 0.9x	0.77	x	1.04	x	24.19	x	0.63	x	0.7	=	7.69	(74)
North 0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North 0.9x	0.77	x	1.04	x	13.12	x	0.63	x	0.7	=	4.17	(74)
North 0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North 0.9x	0.77	x	1.04	x	8.86	x	0.63	x	0.7	=	2.82	(74)
Northeast 0.9x	0.77	x	7.82	x	11.28	x	0.63	x	0.7	=	26.97	(75)
Northeast 0.9x	0.77	x	7.82	x	22.97	x	0.63	x	0.7	=	54.89	(75)
Northeast 0.9x	0.77	x	7.82	x	41.38	x	0.63	x	0.7	=	98.89	(75)
Northeast 0.9x	0.77	x	7.82	x	67.96	x	0.63	x	0.7	=	162.41	(75)
Northeast 0.9x	0.77	x	7.82	x	91.35	x	0.63	x	0.7	=	218.31	(75)
Northeast 0.9x	0.77	x	7.82	x	97.38	x	0.63	x	0.7	=	232.74	(75)
Northeast 0.9x	0.77	x	7.82	x	91.1	x	0.63	x	0.7	=	217.72	(75)
Northeast 0.9x	0.77	x	7.82	x	72.63	x	0.63	x	0.7	=	173.57	(75)
Northeast 0.9x	0.77	x	7.82	x	50.42	x	0.63	x	0.7	=	120.5	(75)
Northeast 0.9x	0.77	x	7.82	x	28.07	x	0.63	x	0.7	=	67.08	(75)
Northeast 0.9x	0.77	x	7.82	x	14.2	x	0.63	x	0.7	=	33.93	(75)
Northeast 0.9x	0.77	x	7.82	x	9.21	x	0.63	x	0.7	=	22.02	(75)
Southeast 0.9x	0.77	x	6.42	x	36.79	x	0.63	x	0.7	=	72.19	(77)
Southeast 0.9x	0.77	x	6.42	x	62.67	x	0.63	x	0.7	=	122.97	(77)
Southeast 0.9x	0.77	x	6.42	x	85.75	x	0.63	x	0.7	=	168.25	(77)

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Southeast	0.9x	0.77	x	6.42	x	106.25	x	0.63	x	0.7	=	208.47	(77)
Southeast	0.9x	0.77	x	6.42	x	119.01	x	0.63	x	0.7	=	233.5	(77)
Southeast	0.9x	0.77	x	6.42	x	118.15	x	0.63	x	0.7	=	231.81	(77)
Southeast	0.9x	0.77	x	6.42	x	113.91	x	0.63	x	0.7	=	223.49	(77)
Southeast	0.9x	0.77	x	6.42	x	104.39	x	0.63	x	0.7	=	204.82	(77)
Southeast	0.9x	0.77	x	6.42	x	92.85	x	0.63	x	0.7	=	182.18	(77)
Southeast	0.9x	0.77	x	6.42	x	69.27	x	0.63	x	0.7	=	135.91	(77)
Southeast	0.9x	0.77	x	6.42	x	44.07	x	0.63	x	0.7	=	86.47	(77)
Southeast	0.9x	0.77	x	6.42	x	31.49	x	0.63	x	0.7	=	61.78	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.7	x	46.75	x	0.63	x	0.7	=	24.29	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.7	x	76.57	x	0.63	x	0.7	=	39.78	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.7	x	97.53	x	0.63	x	0.7	=	50.67	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.7	x	110.23	x	0.63	x	0.7	=	57.27	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.7	x	114.87	x	0.63	x	0.7	=	59.68	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.7	x	110.55	x	0.63	x	0.7	=	57.43	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.7	x	108.01	x	0.63	x	0.7	=	56.12	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.7	x	104.89	x	0.63	x	0.7	=	54.5	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.7	x	101.89	x	0.63	x	0.7	=	52.93	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.7	x	82.59	x	0.63	x	0.7	=	42.91	(78)
South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.7	x	55.42	x	0.63	x	0.7	=	28.79	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.7	x	40.4	x	0.63	x	0.7	=	20.99	(78)
West	0.9x	0.77	x	10.84	x	19.64	x	0.63	x	0.7	=	65.07	(80)
West	0.9x	0.77	x	10.84	x	38.42	x	0.63	x	0.7	=	127.28	(80)
West	0.9x	0.77	x	10.84	x	63.27	x	0.63	x	0.7	=	209.61	(80)
West	0.9x	0.77	x	10.84	x	92.28	x	0.63	x	0.7	=	305.71	(80)
West	0.9x	0.77	x	10.84	x	113.09	x	0.63	x	0.7	=	374.66	(80)
West	0.9x	0.77	x	10.84	x	115.77	x	0.63	x	0.7	=	383.53	(80)
West	0.9x	0.77	x	10.84	x	110.22	x	0.63	x	0.7	=	365.14	(80)
West	0.9x	0.77	x	10.84	x	94.68	x	0.63	x	0.7	=	313.65	(80)

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West	0.9x	0.77	x	10.84	x	73.59	x	0.63	x	0.7	=	243.79	(80)
West	0.9x	0.77	x	10.84	x	45.59	x	0.63	x	0.7	=	151.03	(80)
West	0.9x	0.77	x	10.84	x	24.49	x	0.63	x	0.7	=	81.13	(80)
West	0.9x	0.77	x	10.84	x	16.15	x	0.63	x	0.7	=	53.51	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	212.42	386.5	587.64	815.68	985.58	1007.97	959.66	829.8	666.86	443.68	259.08	178.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	723.79	895.63	1080.06	1280.87	1422.65	1418.27	1352.78	1229.45	1080.66	884.94	731.94	675.7	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.69	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.26	20.54	20.83	20.96	21	21	21	20.98	20.75	20.34	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.18	19.57	19.97	20.13	20.17	20.17	20.17	20.15	19.88	19.31	18.85	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	721.46	885.79	1036.82	1098.75	946.96	653.63	437.7	458.38	692.61	821.73	725.54	674.21	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1714.5	1668.99	1522.63	1276.68	980.68	656.7	437.98	459.03	712.35	1076.43	1416.28	1704.56	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3233.19 (98)

Space heating requirement in kWh/m²/year 26.45 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
790.19	562.9	386.57	137.02	26.83	0	0	0	0	202.67	531.91	819.87	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3457.96 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Efficiency of water heater 79.8 (216)

(217)m=	87.83	87.38	86.36	83.93	80.99	79.8	79.8	79.8	79.8	84.86	87.18	87.95

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	247.23	218.98	232.56	214.36	217.56	197.12	189.14	207.78	207.49	219.86	226.48	240.9	

Total = Sum(219a)$_{1...12}$ = 2619.48 (219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1		3457.96
Water heating fuel used		2619.48
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		453.6 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6606.04 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	746.92	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.81	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1312.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	235.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.07	(272)

TER = 18.89 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 37 Flat 37 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	435.66	**(P1)**
Transmission heat loss coefficient:	49.9	
Summer heat loss coefficient:	485.52	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
West (W)	0	1
North (N)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
West (W)	0.9 x	16.35	108.47	0.4	1	0.9	574.6	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1326.38	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	557.81	535.44	544.8	
Total summer gains	1994.64	1861.82	1672.58	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	4.11	3.83	3.44	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.11	21.53	21.04	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:14:01

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 218.74m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 01

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.54 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.60 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	41.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.85 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	33.34m²
Windows facing: North East	31.09m²
Windows facing: North	22.53m²
Windows facing: North	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 38 Flat 38 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	218.74 m²	2.7 m

Living area:	99.26 m² (fraction 0.454)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	33.34	1
NE	16mm or more	0.8	0.4	1	31.09	1
N	16mm or more	1	0.4	1	22.53	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
NE		OPAQUE CURT WALL	North East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	115.29	91.81	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	354.24						N/A
Party Elements							
PARTY WALLS	40.89						N/A
WALLS TO CORRIDOR	40.3						N/A
PARTY CEILING	218.74						N/A

SAP Input

PARTY FLOOR 218.74 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0844

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.58	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 1
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 167.89 (fraction 0.768)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.23	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			31.09	x 1/[1/(1)+ 0.04]		=	29.89			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	115.29	91.81	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			115.29							(31)
Party wall			40.89	x	0	=	0			(32)
Party wall			40.3	x	0	=	0			(32)
Party floor			218.74							(32a)
Party ceiling			218.74							(32b)
Internal wall **			354.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 44513.88 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	80.36	79.24	78.11	72.48	71.35	65.72	65.72	64.59	67.97	71.35	73.6	75.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	184	182.88	181.75	176.12	174.99	169.36	169.36	168.23	171.61	174.99	177.24	179.5	

Average = Sum(39)$_{1...12}$ /12= 175.84 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.83	0.81	0.8	0.77	0.77	0.77	0.78	0.8	0.81	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	

Output from water heater (annual)$_{1...12}$ — 2021.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.49	71.96	75.88	68.45	67.39	60.67	58.69	63.81	63.52	70.96	74.49	79.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	86.59	76.91	62.55	47.35	35.4	29.88	32.29	41.97	56.34	71.53	83.49	89	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	579.89	585.91	570.74	538.46	497.71	459.41	433.82	427.81	442.97	475.25	516	554.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	109.53	107.08	101.99	95.08	90.58	84.26	78.89	85.77	88.22	95.38	103.46	107.09	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	892.72	886.61	851.99	797.6	740.4	690.26	661.71	672.26	704.24	758.87	819.66	867.1	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	22.53	x	10.63	x	0.4	x	1	=	66.41	(74)
North	0.9x	0.77	x	4.85	x	10.63	x	0.4	x	0.7	=	10.01	(74)
North	0.9x	0.77	x	22.53	x	20.32	x	0.4	x	1	=	126.91	(74)
North	0.9x	0.77	x	4.85	x	20.32	x	0.4	x	0.7	=	19.12	(74)
North	0.9x	0.77	x	22.53	x	34.53	x	0.4	x	1	=	215.65	(74)
North	0.9x	0.77	x	4.85	x	34.53	x	0.4	x	0.7	=	32.5	(74)
North	0.9x	0.77	x	22.53	x	55.46	x	0.4	x	1	=	346.39	(74)
North	0.9x	0.77	x	4.85	x	55.46	x	0.4	x	0.7	=	52.2	(74)
North	0.9x	0.77	x	22.53	x	74.72	x	0.4	x	1	=	466.62	(74)
North	0.9x	0.77	x	4.85	x	74.72	x	0.4	x	0.7	=	70.31	(74)
North	0.9x	0.77	x	22.53	x	79.99	x	0.4	x	1	=	499.53	(74)
North	0.9x	0.77	x	4.85	x	79.99	x	0.4	x	0.7	=	75.27	(74)
North	0.9x	0.77	x	22.53	x	74.68	x	0.4	x	1	=	466.38	(74)
North	0.9x	0.77	x	4.85	x	74.68	x	0.4	x	0.7	=	70.28	(74)
North	0.9x	0.77	x	22.53	x	59.25	x	0.4	x	1	=	370.01	(74)
North	0.9x	0.77	x	4.85	x	59.25	x	0.4	x	0.7	=	55.76	(74)
North	0.9x	0.77	x	22.53	x	41.52	x	0.4	x	1	=	259.28	(74)
North	0.9x	0.77	x	4.85	x	41.52	x	0.4	x	0.7	=	39.07	(74)
North	0.9x	0.77	x	22.53	x	24.19	x	0.4	x	1	=	151.07	(74)
North	0.9x	0.77	x	4.85	x	24.19	x	0.4	x	0.7	=	22.76	(74)
North	0.9x	0.77	x	22.53	x	13.12	x	0.4	x	1	=	81.92	(74)
North	0.9x	0.77	x	4.85	x	13.12	x	0.4	x	0.7	=	12.34	(74)
North	0.9x	0.77	x	22.53	x	8.86	x	0.4	x	1	=	55.36	(74)
North	0.9x	0.77	x	4.85	x	8.86	x	0.4	x	0.7	=	8.34	(74)
Northeast	0.9x	0.77	x	31.09	x	11.28	x	0.4	x	0.8	=	77.79	(75)
Northeast	0.9x	0.77	x	31.09	x	22.97	x	0.4	x	0.8	=	158.34	(75)
Northeast	0.9x	0.77	x	31.09	x	41.38	x	0.4	x	0.8	=	285.29	(75)
Northeast	0.9x	0.77	x	31.09	x	67.96	x	0.4	x	0.8	=	468.52	(75)
Northeast	0.9x	0.77	x	31.09	x	91.35	x	0.4	x	0.8	=	629.79	(75)
Northeast	0.9x	0.77	x	31.09	x	97.38	x	0.4	x	0.8	=	671.42	(75)
Northeast	0.9x	0.77	x	31.09	x	91.1	x	0.4	x	0.8	=	628.1	(75)
Northeast	0.9x	0.77	x	31.09	x	72.63	x	0.4	x	0.8	=	500.73	(75)
Northeast	0.9x	0.77	x	31.09	x	50.42	x	0.4	x	0.8	=	347.63	(75)
Northeast	0.9x	0.77	x	31.09	x	28.07	x	0.4	x	0.8	=	193.51	(75)
Northeast	0.9x	0.77	x	31.09	x	14.2	x	0.4	x	0.8	=	97.88	(75)
Northeast	0.9x	0.77	x	31.09	x	9.21	x	0.4	x	0.8	=	63.53	(75)
Northwest	0.9x	0.77	x	33.34	x	11.28	x	0.4	x	0.8	=	83.42	(81)
Northwest	0.9x	0.77	x	33.34	x	22.97	x	0.4	x	0.8	=	169.8	(81)
Northwest	0.9x	0.77	x	33.34	x	41.38	x	0.4	x	0.8	=	305.93	(81)
Northwest	0.9x	0.77	x	33.34	x	67.96	x	0.4	x	0.8	=	502.43	(81)
Northwest	0.9x	0.77	x	33.34	x	91.35	x	0.4	x	0.8	=	675.36	(81)

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Northwest	0.9x	0.77	x	33.34	x	97.38	x	0.4	x	0.8	=	720.01	(81)
Northwest	0.9x	0.77	x	33.34	x	91.1	x	0.4	x	0.8	=	673.55	(81)
Northwest	0.9x	0.77	x	33.34	x	72.63	x	0.4	x	0.8	=	536.97	(81)
Northwest	0.9x	0.77	x	33.34	x	50.42	x	0.4	x	0.8	=	372.78	(81)
Northwest	0.9x	0.77	x	33.34	x	28.07	x	0.4	x	0.8	=	207.51	(81)
Northwest	0.9x	0.77	x	33.34	x	14.2	x	0.4	x	0.8	=	104.96	(81)
Northwest	0.9x	0.77	x	33.34	x	9.21	x	0.4	x	0.8	=	68.13	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	237.63	474.18	839.37	1369.54	1842.09	1966.24	1838.31	1463.46	1018.77	574.86	297.11	195.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1130.35	1360.79	1691.36	2167.14	2582.49	2656.5	2500.02	2135.72	1723	1333.73	1116.78	1062.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.9	0.76	0.57	0.4	0.29	0.35	0.61	0.87	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.2	19.49	19.98	20.55	20.86	20.97	20.99	20.99	20.88	20.39	19.71	19.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.23	20.25	20.25	20.28	20.28	20.28	20.27	20.25	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.89	0.74	0.54	0.35	0.25	0.3	0.56	0.85	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.76	18.19	18.89	19.7	20.1	20.25	20.27	20.27	20.14	19.5	18.53	17.75	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.87	0.73	0.54	0.37	0.27	0.33	0.58	0.84	0.94	0.97	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1084.44	1269.12	1471.42	1581.21	1407.26	988.03	671.12	694.65	993.53	1117.84	1048.06	1025.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2596.98	2538.45	2341.19	1970.13	1530.08	1012.11	677.01	705.57	1094.31	1627.57	2120.42	2548.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5280.94	(98)
Space heating requirement in kWh/m²/year	24.14	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1591.95	1253.24	1278.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.96	0.94	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1498.19	1207.04	1202.66	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2988.46	2810.38	2382.8	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1072.99	1192.89	878.03	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	3143.91	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.77	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	205.89	228.9	168.48	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	603.26	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	2.76	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	661.96	501.76	380.65	164.72	53.75	0	0	0	0	223.08	454.17	666.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	3106.43	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Total = Sum(219a)$_{1...12}$ = 2021.55 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	34.66	38.53	28.36	0	0	0	0

Total = Sum(221)$_{6...8}$ = 101.56 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3106.43
Water heating fuel used		2021.55
Space cooling fuel used		101.56
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	666.49	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		666.49 (231)
Electricity for lighting		611.71 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6507.74 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	409.74 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	266.64 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.4 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	87.91 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	80.68 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		858.37 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.93	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	1612.24	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1049.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2661.43	(265)
Space cooling	(221) x		0.519	=	52.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	345.91	(267)
Electricity for lighting	(232) x		0.519	=	317.48	(268)
Total CO2, kg/year		sum of (265)…(271) =			3377.52	(272)
CO2 emissions per m²		(272) ÷ (4) =			15.44	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	9536.75	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6206.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				15742.92	(265)
Space cooling	(221) x		3.07	=	311.79	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	2046.12	(267)
Electricity for lighting	(232) x		0	=	1877.94	(268)
'Total Primary Energy		sum of (265)…(271) =			19978.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			91.34	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.07 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.32 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 2			18.52	x1/[1/(1.5)+ 0.04] =	26.21			(27)
Windows Type 3			13.42	x1/[1/(1.5)+ 0.04] =	18.99			(27)
Windows Type 4			2.89	x1/[1/(1.5)+ 0.04] =	4.09			(27)
Walls	115.29	54.69	60.6	x 0.18 =	10.91			(29)
Total area of elements, m²			115.29					(31)
Party wall			40.89	x 0 =	0			(32)
Party wall			40.3	x 0 =	0			(32)
Party floor			218.74					(32a)
Party ceiling			218.74					(32b)
Internal wall **			354.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 88.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 45033.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.5 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 97.8 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	111.13	110.6	110.08	107.63	107.18	105.05	105.05	104.65	105.87	107.18	108.1	109.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	208.94	208.4	207.88	205.44	204.98	202.85	202.85	202.45	203.67	204.98	205.91	206.87	

Average = Sum(39)$_{1...12}$ /12= 205.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	

Output from water heater (annual)$_{1...12}$ — 2258.75 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.61	86.52	92	84.05	83.51	76.26	74.81	79.93	79.11	87.08	90.09	95.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	34.64	30.76	25.02	18.94	14.16	11.95	12.92	16.79	22.53	28.61	33.39	35.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	388.52	392.56	382.4	360.77	333.47	307.81	290.66	286.63	296.79	318.42	345.72	371.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	131.19	128.74	123.65	116.74	112.25	105.92	100.55	107.43	109.88	117.04	125.13	128.75	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	625.75	623.46	602.47	567.84	531.27	497.08	475.52	482.25	500.6	535.47	575.64	607.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	13.42	x	10.63	x	0.63	x	0.7	=	43.61	(74)
North	0.9x	0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x	0.77	x	13.42	x	20.32	x	0.63	x	0.7	=	83.34	(74)
North	0.9x	0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x	0.77	x	13.42	x	34.53	x	0.63	x	0.7	=	141.62	(74)
North	0.9x	0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x	0.77	x	13.42	x	55.46	x	0.63	x	0.7	=	227.48	(74)
North	0.9x	0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x	0.77	x	13.42	x	74.72	x	0.63	x	0.7	=	306.43	(74)
North	0.9x	0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x	0.77	x	13.42	x	79.99	x	0.63	x	0.7	=	328.05	(74)
North	0.9x	0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x	0.77	x	13.42	x	74.68	x	0.63	x	0.7	=	306.27	(74)
North	0.9x	0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	13.42	x	59.25	x	0.63	x	0.7	=	242.99	(74)
North	0.9x	0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x	0.77	x	13.42	x	41.52	x	0.63	x	0.7	=	170.27	(74)
North	0.9x	0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x	0.77	x	13.42	x	24.19	x	0.63	x	0.7	=	99.21	(74)
North	0.9x	0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x	0.77	x	13.42	x	13.12	x	0.63	x	0.7	=	53.8	(74)
North	0.9x	0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x	0.77	x	13.42	x	8.86	x	0.63	x	0.7	=	36.36	(74)
North	0.9x	0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
Northeast	0.9x	0.77	x	18.52	x	11.28	x	0.63	x	0.7	=	63.86	(75)
Northeast	0.9x	0.77	x	18.52	x	22.97	x	0.63	x	0.7	=	129.99	(75)
Northeast	0.9x	0.77	x	18.52	x	41.38	x	0.63	x	0.7	=	234.2	(75)
Northeast	0.9x	0.77	x	18.52	x	67.96	x	0.63	x	0.7	=	384.63	(75)
Northeast	0.9x	0.77	x	18.52	x	91.35	x	0.63	x	0.7	=	517.01	(75)
Northeast	0.9x	0.77	x	18.52	x	97.38	x	0.63	x	0.7	=	551.19	(75)
Northeast	0.9x	0.77	x	18.52	x	91.1	x	0.63	x	0.7	=	515.63	(75)
Northeast	0.9x	0.77	x	18.52	x	72.63	x	0.63	x	0.7	=	411.06	(75)
Northeast	0.9x	0.77	x	18.52	x	50.42	x	0.63	x	0.7	=	285.38	(75)
Northeast	0.9x	0.77	x	18.52	x	28.07	x	0.63	x	0.7	=	158.86	(75)
Northeast	0.9x	0.77	x	18.52	x	14.2	x	0.63	x	0.7	=	80.35	(75)
Northeast	0.9x	0.77	x	18.52	x	9.21	x	0.63	x	0.7	=	52.15	(75)
Northwest	0.9x	0.77	x	19.86	x	11.28	x	0.63	x	0.7	=	68.48	(81)
Northwest	0.9x	0.77	x	19.86	x	22.97	x	0.63	x	0.7	=	139.4	(81)
Northwest	0.9x	0.77	x	19.86	x	41.38	x	0.63	x	0.7	=	251.15	(81)
Northwest	0.9x	0.77	x	19.86	x	67.96	x	0.63	x	0.7	=	412.46	(81)
Northwest	0.9x	0.77	x	19.86	x	91.35	x	0.63	x	0.7	=	554.42	(81)

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Northwest	0.9x	0.77	x	19.86	x	97.38	x	0.63	x	0.7	=	591.07	(81)
Northwest	0.9x	0.77	x	19.86	x	91.1	x	0.63	x	0.7	=	552.94	(81)
Northwest	0.9x	0.77	x	19.86	x	72.63	x	0.63	x	0.7	=	440.81	(81)
Northwest	0.9x	0.77	x	19.86	x	50.42	x	0.63	x	0.7	=	306.03	(81)
Northwest	0.9x	0.77	x	19.86	x	28.07	x	0.63	x	0.7	=	170.35	(81)
Northwest	0.9x	0.77	x	19.86	x	14.2	x	0.63	x	0.7	=	86.17	(81)
Northwest	0.9x	0.77	x	19.86	x	9.21	x	0.63	x	0.7	=	55.93	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.35	370.68	657.47	1073.55	1443.86	1540.95	1440.79	1147.19	798.35	449.79	231.91	152.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	811.09	994.14	1259.93	1641.39	1975.12	2038.03	1916.31	1629.44	1298.95	985.25	807.54	759.39	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.97	0.84	0.62	0.46	0.56	0.89	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.95	20.22	20.6	20.89	20.99	21	20.99	20.89	20.49	20.08	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.13	20.14	20.14	20.14	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.96	0.79	0.54	0.37	0.46	0.83	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.7	19.09	19.65	20.03	20.13	20.14	20.14	20.04	19.5	18.91	18.47	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.81	0.58	0.41	0.51	0.85	0.99	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	810.85	993.1	1252.57	1570.68	1599.7	1179.74	794.99	828.47	1108.12	975.94	806.92	759.24	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3090.25	2994.2	2724.06	2297.4	1787.46	1201.01	797.43	835.95	1288.49	1915.57	2540.88	3076.16	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8469.65	(98)
Space heating requirement in kWh/m²/year	38.72	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
1813.76	1438.22	1170.89	559.62	149.4	0	0	0	0	747.69	1335.24	1843.62	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	9058.45	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	
Efficiency of water heater												79.8	(216)
(217)m=	89.11	88.98	88.62	87.44	84.14	79.8	79.8	79.8	79.8	87.96	88.84	89.16	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	250.39	220.93	232.76	211.14	214.81	202.02	193.68	212.99	212.76	217.66	228.28	244.13	
Total = Sum(219a)$_{1...12}$ =												2641.53	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		9058.45	
Water heating fuel used		2641.53	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		611.71	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		12386.69	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	1956.63	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	570.57	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2527.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	317.48	(268)
Total CO2, kg/year	sum of (265)…(271) =			2883.6	(272)

TER = 19.54 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 38 Flat 38 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	779.59	**(P1)**
Transmission heat loss coefficient:	103.6	
Summer heat loss coefficient:	883.23	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North West (NW)	0	1
North East (NE)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North West (NW)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
North West (NW)	0.9 x	33.34	89.66	0.4	0.8	0.9	774.78	
North East (NE)	0.9 x	31.09	89.66	0.4	0.8	0.9	722.49	
North (N)	0.9 x	22.53	73.49	0.4	1	0.9	536.47	
North (N GLAZED DOOR)	0.9 x	4.85	73.49	0.4	0.7	0.9	80.84	
						Total	2114.57	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	690.26	661.71	672.26	
Total summer gains	3022.94	2776.28	2328.33	**(P5)**
Summer gain/loss ratio	3.42	3.14	2.64	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.42	20.84	20.24	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Not significant**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:56

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 121.32m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 02

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.47 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: East	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 38 Flat 38 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	121.32 m²	2.7 m
Living area:	62.23 m² (fraction 0.513)	
Front of dwelling faces:	West	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	0.8	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	55.49	46.1	9.39	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	44.87						N/A
PARTY CEILING	121.32						N/A
PARTY FLOOR	121.32						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0736

	Length	Psi-value		
[Approved]	28.1	0.05	E4	Jamb
[Approved]	30.74	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.25	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.91	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 105.55 (fraction 0.870)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32 (1a)	x	2.7 (2a)	=	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x	1/[1/(1)+ 0.04]	=	9.31			(27)
Windows Type 2			11.79	x	1/[1/(1)+ 0.04]	=	11.34			(27)
Windows Type 3			1.59	x	1/[1/(1)+ 0.04]	=	1.53			(27)
Windows Type 4			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 5			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 6			16.35	x	1/[1/(1)+ 0.04]	=	15.72			(27)
Windows Type 7			1.57	x	1/[1/(1)+ 0.04]	=	1.51			(27)
Walls	55.49	46.1	9.39	x	0.24	=	2.25			(29)
Total area of elements, m²			55.49							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			44.87	x	0	=	0			(32)
Party floor			121.32							(32a)
Party ceiling			121.32							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.58 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25283.07 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 4.09 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.4	38.88	38.36	35.74	35.22	32.6	32.6	32.07	33.64	35.22	36.26	37.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.07	89.55	89.02	86.41	85.88	83.26	83.26	82.74	84.31	85.88	86.93	87.98	

Average = Sum(39)$_{1...12}$ /12= 86.27 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.69	0.69	0.68	0.69	0.71	0.72	0.73	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.61 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Output from water heater (annual)$_{1...12}$ — 1962.51 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.46	70.18	74.05	66.85	65.86	59.34	57.46	62.4	62.09	69.3	72.68	77.7	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	63.95	56.8	46.19	34.97	26.14	22.07	23.85	31	41.6	52.82	61.65	65.73	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	428.24	432.69	421.49	397.65	367.55	339.27	320.38	315.93	327.13	350.97	381.06	409.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	106.8	104.43	99.52	92.85	88.52	82.42	77.23	83.88	86.24	93.14	100.94	104.44	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	711.43	706.36	679.65	637.91	594.66	556.2	533.9	543.25	567.41	609.38	656.1	691.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
East 0.9x	0.77	x	16.35	x	19.64	x	0.4	x	0.8	=	71.21	(76)
East 0.9x	0.77	x	16.35	x	38.42	x	0.4	x	0.8	=	139.3	(76)
East 0.9x	0.77	x	16.35	x	63.27	x	0.4	x	0.8	=	229.41	(76)

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East	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	0.8	=	334.59	(76)
East	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	0.8	=	410.05	(76)
East	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	0.8	=	419.76	(76)
East	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	0.8	=	399.63	(76)
East	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	0.8	=	343.27	(76)
East	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	0.8	=	266.82	(76)
East	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	0.8	=	165.3	(76)
East	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	0.8	=	88.79	(76)
East	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	0.8	=	58.56	(76)
Southeast	0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast	0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast	0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)
Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)

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South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	233.43	424.61	645.3	895.38	1081.67	1106.18	1053.19	910.8	732.17	487.34	284.69	196.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	944.86	1130.97	1324.94	1533.29	1676.33	1662.38	1587.09	1454.05	1299.59	1096.72	940.79	888.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.86	0.77	0.62	0.46	0.32	0.23	0.26	0.43	0.7	0.87	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.78	20.32	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.31	20.31	20.33	20.33	20.35	20.35	20.36	20.35	20.33	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.85	0.75	0.59	0.43	0.29	0.2	0.22	0.4	0.67	0.85	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.84	19.25	19.71	20.12	20.28	20.34	20.35	20.35	20.32	20.07	19.44	18.8	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.84	0.74	0.6	0.44	0.3	0.21	0.24	0.41	0.67	0.84	0.91	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	844.34	945.75	985.21	913.63	741	501.55	339.07	353.02	538.27	736.67	792.25	805.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1358.7	1328.54	1213.65	1000.63	766.21	505.89	339.96	354.44	552.33	844.33	1112.16	1332.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1594.2 (98)

Space heating requirement in kWh/m²/year 13.14 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	782.68	616.15	628.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	763.57	607.91	616.98	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1849.14	1764.9	1607.82	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	781.61	860.8	737.18	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 2379.6 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	170	187.23	160.34	0	0	0	0	

Total = Sum(107)$_{6...8}$ = 517.57 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.27 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	225.11	151.31	99.97	36.85	11.03	0	0	0	0	47.12	135.49	230.88	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 937.77 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59

Efficiency of water heater — 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Total = Sum(219a)$_{1...12}$ = 1962.51 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	28.62	31.52	26.99	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 87.13 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.77	
Water heating fuel used		1962.51	
Space cooling fuel used		87.13	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	369.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	369.66	(231)
Electricity for lighting		451.74	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3808.8	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	123.69	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	258.85	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.49	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	48.76	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.58	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				502.38	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.3	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.7	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1018.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1505.24	(265)
Space cooling	(221)	x	0.519	=	45.22	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	191.85	(267)
Electricity for lighting	(232)	x	0.519	=	234.45	(268)
Total CO2, kg/year		sum of (265)…(271) =			1976.77	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.29	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2878.94	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6024.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8903.83	(265)
Space cooling	(221)	x	3.07	=	267.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	1134.84	(267)
Electricity for lighting	(232)	x	0	=	1386.84	(268)
'Total Primary Energy		sum of (265)…(271) =			11693.01	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			96.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32 (1a)	x	2.7 (2a)	=	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.37	x1/[1/(1.5)+ 0.04] =	9.01			(27)
Windows Type 2			7.76	x1/[1/(1.5)+ 0.04] =	10.98			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 5			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 6			10.76	x1/[1/(1.5)+ 0.04] =	15.23			(27)
Windows Type 7			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Walls	55.49	30.33	25.16	x 0.18 =	4.53			(29)
Total area of elements, m²			55.49					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			44.87	x 0 =	0			(32)
Party floor			121.32					(32a)
Party ceiling			121.32					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.45 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25503.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.33 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.36	61.07	60.79	59.49	59.24	58.1	58.1	57.89	58.54	59.24	59.74	60.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.68	112.4	112.12	110.82	110.57	109.43	109.43	109.22	109.87	110.57	111.07	111.58	

Average = Sum(39)$_{1...12}$ /12= 110.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.92	0.91	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	

Output from water heater (annual)$_{1...12}$	2199.71	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.57	84.73	90.16	82.45	81.97	74.94	73.58	78.52	77.69	85.42	88.28	93.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.58	22.72	18.48	13.99	10.46	8.83	9.54	12.4	16.64	21.13	24.66	26.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	286.92	289.9	282.4	266.42	246.26	227.31	214.65	211.67	219.18	235.15	255.31	274.26	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	128.46	126.09	121.19	114.51	110.18	104.08	98.9	105.54	107.9	114.81	122.6	126.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	509.98	507.74	491.08	463.95	435.92	409.24	392.11	398.64	412.74	440.11	471.6	495.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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TER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)
North	0.9x	0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
Northeast	0.9x	0.77	x	7.76	x	11.28	x	0.63	x	0.7	=	26.76	(75)
Northeast	0.9x	0.77	x	7.76	x	22.97	x	0.63	x	0.7	=	54.47	(75)
Northeast	0.9x	0.77	x	7.76	x	41.38	x	0.63	x	0.7	=	98.13	(75)
Northeast	0.9x	0.77	x	7.76	x	67.96	x	0.63	x	0.7	=	161.16	(75)
Northeast	0.9x	0.77	x	7.76	x	91.35	x	0.63	x	0.7	=	216.63	(75)
Northeast	0.9x	0.77	x	7.76	x	97.38	x	0.63	x	0.7	=	230.95	(75)
Northeast	0.9x	0.77	x	7.76	x	91.1	x	0.63	x	0.7	=	216.05	(75)
Northeast	0.9x	0.77	x	7.76	x	72.63	x	0.63	x	0.7	=	172.24	(75)
Northeast	0.9x	0.77	x	7.76	x	50.42	x	0.63	x	0.7	=	119.58	(75)
Northeast	0.9x	0.77	x	7.76	x	28.07	x	0.63	x	0.7	=	66.56	(75)
Northeast	0.9x	0.77	x	7.76	x	14.2	x	0.63	x	0.7	=	33.67	(75)
Northeast	0.9x	0.77	x	7.76	x	9.21	x	0.63	x	0.7	=	21.85	(75)
East	0.9x	0.77	x	10.76	x	19.64	x	0.63	x	0.7	=	64.58	(76)
East	0.9x	0.77	x	10.76	x	38.42	x	0.63	x	0.7	=	126.34	(76)
East	0.9x	0.77	x	10.76	x	63.27	x	0.63	x	0.7	=	208.07	(76)

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East	0.9x	0.77	x	10.76	x	92.28	x	0.63	x	0.7	=	303.45	(76)
East	0.9x	0.77	x	10.76	x	113.09	x	0.63	x	0.7	=	371.89	(76)
East	0.9x	0.77	x	10.76	x	115.77	x	0.63	x	0.7	=	380.7	(76)
East	0.9x	0.77	x	10.76	x	110.22	x	0.63	x	0.7	=	362.44	(76)
East	0.9x	0.77	x	10.76	x	94.68	x	0.63	x	0.7	=	311.33	(76)
East	0.9x	0.77	x	10.76	x	73.59	x	0.63	x	0.7	=	241.99	(76)
East	0.9x	0.77	x	10.76	x	45.59	x	0.63	x	0.7	=	149.92	(76)
East	0.9x	0.77	x	10.76	x	24.49	x	0.63	x	0.7	=	80.53	(76)
East	0.9x	0.77	x	10.76	x	16.15	x	0.63	x	0.7	=	53.11	(76)
Southeast	0.9x	0.77	x	6.37	x	36.79	x	0.63	x	0.7	=	71.63	(77)
Southeast	0.9x	0.77	x	6.37	x	62.67	x	0.63	x	0.7	=	122.01	(77)
Southeast	0.9x	0.77	x	6.37	x	85.75	x	0.63	x	0.7	=	166.94	(77)
Southeast	0.9x	0.77	x	6.37	x	106.25	x	0.63	x	0.7	=	206.85	(77)
Southeast	0.9x	0.77	x	6.37	x	119.01	x	0.63	x	0.7	=	231.68	(77)
Southeast	0.9x	0.77	x	6.37	x	118.15	x	0.63	x	0.7	=	230.01	(77)
Southeast	0.9x	0.77	x	6.37	x	113.91	x	0.63	x	0.7	=	221.75	(77)
Southeast	0.9x	0.77	x	6.37	x	104.39	x	0.63	x	0.7	=	203.22	(77)
Southeast	0.9x	0.77	x	6.37	x	92.85	x	0.63	x	0.7	=	180.76	(77)
Southeast	0.9x	0.77	x	6.37	x	69.27	x	0.63	x	0.7	=	134.85	(77)
Southeast	0.9x	0.77	x	6.37	x	44.07	x	0.63	x	0.7	=	85.79	(77)
Southeast	0.9x	0.77	x	6.37	x	31.49	x	0.63	x	0.7	=	61.3	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)

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South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	210.78	383.53	583.11	809.37	977.93	1000.14	952.21	823.38	661.72	440.26	257.09	177.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	720.77	891.27	1074.19	1273.32	1413.85	1409.38	1344.32	1222.01	1074.46	880.37	728.7	672.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.7	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.25	20.53	20.82	20.96	21	21	21	20.98	20.74	20.34	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.61	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.16	19.56	19.96	20.13	20.16	20.17	20.17	20.15	19.87	19.29	18.84	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	718.4	881.41	1031.31	1093.72	944.32	652.34	436.71	457.36	690.72	817.73	722.26	671.48	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1711.46	1666.06	1519.97	1274.59	979.16	655.56	437.01	458.05	711.1	1074.5	1413.77	1701.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3241.14 (98)

Space heating requirement in kWh/m²/year 26.72 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	790.2	563.94	388.84	139.28	27.72	0	0	0	0	204.32	532.5	819.67	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3466.46 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	
Efficiency of water heater													79.8 (216)
(217)m=	87.83	87.38	86.38	83.97	81.03	79.8	79.8	79.8	79.8	84.88	87.18	87.95	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	247.08	218.84	232.39	214.14	217.34	197.02	189.05	207.67	207.38	219.68	226.34	240.76	

Total = Sum(219a)$_{1...12}$ = 2617.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3466.46
Water heating fuel used		2617.68
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		451.74 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6610.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	748.76	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.42	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1314.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	234.45	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.55	(272)

TER = 19.04 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 38 Flat 38 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	432.38	**(P1)**
Transmission heat loss coefficient:	50.7	
Summer heat loss coefficient:	483.05	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
East (E)	0	1
North (N)	0	1

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Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
East (E)	0.9 x	16.35	108.47	0.4	0.8	0.9	459.68	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1211.46	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	556.2	533.9	543.25	
Total summer gains	1868.53	1745.36	1573.92	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	3.87	3.61	3.26	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.87	21.31	20.86	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:50

Project Information:

Assessed By: ()
Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE
Total Floor Area: 236.67m²
Site Reference : P1785 St Michaels
Plot Reference: Level 38 Flat 38 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	14.49 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	33.34m²
Windows facing: South West	30.67m²
Windows facing: South	22.53m²
Windows facing: South	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 38 Flat 38 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	236.67 m²	2.7 m

Living area:	98.45 m² (fraction 0.416)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	33.34	1
SW	16mm or more	0.8	0.4	1	30.67	1
S	16mm or more	1	0.4	1	22.53	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South West	0	0
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	114.87	91.39	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	391.77						N/A
Party Elements							
PARTY WALLS	35.74						N/A
WALLS TO CORRIDOR	28.53						N/A
PARTY CEILING	236.67						N/A

SAP Input

PARTY FLOOR	236.67	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0843

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.02	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.58	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 205.31 (fraction 0.867)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			30.67	x 1/[1/(1)+ 0.04]		=	29.49			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	114.87	91.39	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			114.87							(31)
Party wall			35.74	x	0	=	0			(32)
Party wall			28.53	x	0	=	0			(32)
Party floor			236.67							(32a)
Party ceiling			236.67							(32b)
Internal wall **			391.77							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 47740.65 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.69 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.2 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	76.87	75.85	74.83	69.72	68.7	63.59	63.59	62.57	65.63	68.7	70.74	72.78	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	180.07	179.05	178.02	172.92	171.9	166.79	166.79	165.77	168.83	171.9	173.94	175.98	

Average = Sum(39)$_{1...12}$ /12= 172.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.76	0.76	0.75	0.73	0.73	0.7	0.7	0.7	0.71	0.73	0.73	0.74	

Average = Sum(40)$_{1...12}$ /12= 0.73 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	

Output from water heater (annual)$_{1...12}$ — 2030.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.79	72.22	76.15	68.69	67.62	60.86	58.87	64.02	63.73	71.21	74.76	79.97	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	90.2	80.11	65.15	49.32	36.87	31.13	33.63	43.72	58.68	74.51	86.96	92.7	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	604.01	610.28	594.48	560.86	518.41	478.52	451.87	445.6	461.4	495.02	537.47	577.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	109.93	107.47	102.36	95.4	90.89	84.53	79.13	86.05	88.51	95.71	103.84	107.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	921.48	915.2	879.33	822.92	763.51	711.52	681.97	692.71	725.93	782.58	845.6	894.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	22.53	x	46.75	x	0.4	x	1	=	291.98	(78)
South	0.9x	0.77	x	4.85	x	46.75	x	0.4	x	0.7	=	44	(78)
South	0.9x	0.77	x	22.53	x	76.57	x	0.4	x	1	=	478.19	(78)
South	0.9x	0.77	x	4.85	x	76.57	x	0.4	x	0.7	=	72.06	(78)
South	0.9x	0.77	x	22.53	x	97.53	x	0.4	x	1	=	609.13	(78)
South	0.9x	0.77	x	4.85	x	97.53	x	0.4	x	0.7	=	91.79	(78)
South	0.9x	0.77	x	22.53	x	110.23	x	0.4	x	1	=	688.45	(78)
South	0.9x	0.77	x	4.85	x	110.23	x	0.4	x	0.7	=	103.74	(78)
South	0.9x	0.77	x	22.53	x	114.87	x	0.4	x	1	=	717.41	(78)
South	0.9x	0.77	x	4.85	x	114.87	x	0.4	x	0.7	=	108.1	(78)
South	0.9x	0.77	x	22.53	x	110.55	x	0.4	x	1	=	690.41	(78)
South	0.9x	0.77	x	4.85	x	110.55	x	0.4	x	0.7	=	104.04	(78)
South	0.9x	0.77	x	22.53	x	108.01	x	0.4	x	1	=	674.57	(78)
South	0.9x	0.77	x	4.85	x	108.01	x	0.4	x	0.7	=	101.65	(78)
South	0.9x	0.77	x	22.53	x	104.89	x	0.4	x	1	=	655.1	(78)
South	0.9x	0.77	x	4.85	x	104.89	x	0.4	x	0.7	=	98.72	(78)
South	0.9x	0.77	x	22.53	x	101.89	x	0.4	x	1	=	636.31	(78)
South	0.9x	0.77	x	4.85	x	101.89	x	0.4	x	0.7	=	95.88	(78)
South	0.9x	0.77	x	22.53	x	82.59	x	0.4	x	1	=	515.77	(78)
South	0.9x	0.77	x	4.85	x	82.59	x	0.4	x	0.7	=	77.72	(78)
South	0.9x	0.77	x	22.53	x	55.42	x	0.4	x	1	=	346.1	(78)
South	0.9x	0.77	x	4.85	x	55.42	x	0.4	x	0.7	=	52.15	(78)
South	0.9x	0.77	x	22.53	x	40.4	x	0.4	x	1	=	252.3	(78)
South	0.9x	0.77	x	4.85	x	40.4	x	0.4	x	0.7	=	38.02	(78)
Southwest	0.9x	0.77	x	33.34	x	36.79		0.4	x	0.8	=	272.03	(79)
Southwest	0.9x	0.77	x	30.67	x	36.79		0.4	x	0.8	=	250.25	(79)
Southwest	0.9x	0.77	x	33.34	x	62.67		0.4	x	0.8	=	463.38	(79)
Southwest	0.9x	0.77	x	30.67	x	62.67		0.4	x	0.8	=	426.27	(79)
Southwest	0.9x	0.77	x	33.34	x	85.75		0.4	x	0.8	=	634.01	(79)
Southwest	0.9x	0.77	x	30.67	x	85.75		0.4	x	0.8	=	583.24	(79)
Southwest	0.9x	0.77	x	33.34	x	106.25		0.4	x	0.8	=	785.57	(79)
Southwest	0.9x	0.77	x	30.67	x	106.25		0.4	x	0.8	=	722.66	(79)
Southwest	0.9x	0.77	x	33.34	x	119.01		0.4	x	0.8	=	879.9	(79)
Southwest	0.9x	0.77	x	30.67	x	119.01		0.4	x	0.8	=	809.44	(79)
Southwest	0.9x	0.77	x	33.34	x	118.15		0.4	x	0.8	=	873.54	(79)
Southwest	0.9x	0.77	x	30.67	x	118.15		0.4	x	0.8	=	803.58	(79)
Southwest	0.9x	0.77	x	33.34	x	113.91		0.4	x	0.8	=	842.19	(79)
Southwest	0.9x	0.77	x	30.67	x	113.91		0.4	x	0.8	=	774.74	(79)
Southwest	0.9x	0.77	x	33.34	x	104.39		0.4	x	0.8	=	771.81	(79)
Southwest	0.9x	0.77	x	30.67	x	104.39		0.4	x	0.8	=	710	(79)
Southwest	0.9x	0.77	x	33.34	x	92.85		0.4	x	0.8	=	686.5	(79)

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Southwest 0.9x	0.77	x	30.67	x	92.85	0.4	x	0.8	=	631.52	(79)
Southwest 0.9x	0.77	x	33.34	x	69.27	0.4	x	0.8	=	512.13	(79)
Southwest 0.9x	0.77	x	30.67	x	69.27	0.4	x	0.8	=	471.11	(79)
Southwest 0.9x	0.77	x	33.34	x	44.07	0.4	x	0.8	=	325.83	(79)
Southwest 0.9x	0.77	x	30.67	x	44.07	0.4	x	0.8	=	299.74	(79)
Southwest 0.9x	0.77	x	33.34	x	31.49	0.4	x	0.8	=	232.8	(79)
Southwest 0.9x	0.77	x	30.67	x	31.49	0.4	x	0.8	=	214.16	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	858.26	1439.89	1918.16	2300.42	2514.85	2471.56	2393.14	2235.62	2050.21	1576.74	1023.83	737.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	1779.74	2355.09	2797.49	3123.34	3278.36	3183.08	3075.12	2928.33	2776.14	2359.31	1869.43	1632.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.85	0.74	0.61	0.47	0.33	0.24	0.26	0.41	0.66	0.87	0.94	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.81	20.22	20.56	20.82	20.94	20.99	21	21	20.97	20.8	20.3	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.29	20.29	20.29	20.31	20.32	20.34	20.34	20.34	20.33	20.32	20.31	20.3	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.92	0.83	0.72	0.58	0.44	0.3	0.2	0.22	0.37	0.63	0.85	0.93	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.69	19.27	19.74	20.1	20.25	20.33	20.33	20.34	20.3	20.08	19.4	18.61	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.9	0.82	0.72	0.58	0.45	0.31	0.22	0.24	0.39	0.63	0.84	0.92	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	1603.99	1925.85	2003.79	1820.6	1464.6	990.53	666.8	695.28	1070.65	1496.7	1566.57	1498.19	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	2675.7	2643.94	2417.77	1988.88	1519.44	1000.9	668.87	698.15	1094.29	1681.42	2204.1	2619.78	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3180.79	(98)
Space heating requirement in kWh/m²/year	13.44	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1567.81	1234.23	1259.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1523.49	1215.53	1236.37	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3600.36	3479.15	3305.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1495.34	1684.14	1539.64	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	4719.12	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.87	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	324.3	365.25	333.91	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	1023.45	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.32	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	469.03	283.86	181.18	71.27	24	0	0	0	0	80.84	270.01	490.86	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1871.06	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Total = Sum(219a)$_{1...12}$ = 2030.26 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	54.6	61.49	56.21	0	0	0	0

Total = Sum(221)$_{6...8}$ = 172.3 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1871.06	
Water heating fuel used		2030.26	
Space cooling fuel used		172.3	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	721.12		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	721.12	(231)
Electricity for lighting		637.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5431.89	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	246.79	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	267.79	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	22.73	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	95.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	84.04	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				716.47	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.07	(257)
SAP rating (Section 12)		85.1	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	971.08	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1053.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2024.78	(265)
Space cooling	(221)	x	0.519	=	89.42	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	374.26	(267)
Electricity for lighting	(232)	x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =				2819.15	(272)
CO2 emissions per m²	(272) ÷ (4) =				11.91	(273)
EI rating (section 14)					87	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	5744.14	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6232.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				11977.05	(265)
Space cooling	(221)	x	3.07	=	528.96	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	2213.84	(267)
Electricity for lighting	(232)	x	0	=	1956.05	(268)
'Total Primary Energy	sum of (265)…(271) =				16675.9	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				70.46	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.06 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.31 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.24 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.31	0.3	0.3	0.27	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.58	x1/[1/(1.5)+ 0.04] =	30.54			(27)
Windows Type 2			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 3			14.59	x1/[1/(1.5)+ 0.04] =	20.65			(27)
Windows Type 4			3.14	x1/[1/(1.5)+ 0.04] =	4.44			(27)
Walls	114.87	59.17	55.7	x 0.18 =	10.03			(29)
Total area of elements, m²			114.87					(31)
Party wall			35.74	x 0 =	0			(32)
Party wall			28.53	x 0 =	0			(32)
Party floor			236.67					(32a)
Party ceiling			236.67					(32b)
Internal wall **			391.77					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 48191.73 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.47 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.22 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	115.5	115.11	114.72	112.92	112.59	111.02	111.02	110.73	111.62	112.59	113.27	113.98	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	218.72	218.33	217.95	216.15	215.81	214.24	214.24	213.95	214.85	215.81	216.49	217.2	

Average = Sum(39)$_{1...12}$ /12= 216.15 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.9	0.91	0.91	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	

Output from water heater (annual)$_{1...12}$ — 2267.46 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.91	86.78	92.27	84.29	83.74	76.46	74.99	80.14	79.32	87.32	90.36	96.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	36.08	32.04	26.06	19.73	14.75	12.45	13.45	17.49	23.47	29.8	34.78	37.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	404.69	408.89	398.3	375.78	347.34	320.61	302.75	298.55	309.14	331.66	360.1	386.83	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	131.6	129.13	124.02	117.07	112.55	106.19	100.79	107.71	110.17	117.37	125.5	129.14	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	644.11	641.81	620.13	584.31	546.38	511	488.74	495.5	514.53	550.58	592.13	624.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	14.59	x	46.75	x	0.63	x	0.7	=	208.46	(78)
South	0.9x	0.77	x	3.14	x	46.75	x	0.63	x	0.7	=	44.86	(78)
South	0.9x	0.77	x	14.59	x	76.57	x	0.63	x	0.7	=	341.41	(78)
South	0.9x	0.77	x	3.14	x	76.57	x	0.63	x	0.7	=	73.48	(78)
South	0.9x	0.77	x	14.59	x	97.53	x	0.63	x	0.7	=	434.89	(78)
South	0.9x	0.77	x	3.14	x	97.53	x	0.63	x	0.7	=	93.6	(78)
South	0.9x	0.77	x	14.59	x	110.23	x	0.63	x	0.7	=	491.52	(78)
South	0.9x	0.77	x	3.14	x	110.23	x	0.63	x	0.7	=	105.78	(78)
South	0.9x	0.77	x	14.59	x	114.87	x	0.63	x	0.7	=	512.2	(78)
South	0.9x	0.77	x	3.14	x	114.87	x	0.63	x	0.7	=	110.23	(78)
South	0.9x	0.77	x	14.59	x	110.55	x	0.63	x	0.7	=	492.92	(78)
South	0.9x	0.77	x	3.14	x	110.55	x	0.63	x	0.7	=	106.08	(78)
South	0.9x	0.77	x	14.59	x	108.01	x	0.63	x	0.7	=	481.61	(78)
South	0.9x	0.77	x	3.14	x	108.01	x	0.63	x	0.7	=	103.65	(78)
South	0.9x	0.77	x	14.59	x	104.89	x	0.63	x	0.7	=	467.71	(78)
South	0.9x	0.77	x	3.14	x	104.89	x	0.63	x	0.7	=	100.66	(78)
South	0.9x	0.77	x	14.59	x	101.89	x	0.63	x	0.7	=	454.3	(78)
South	0.9x	0.77	x	3.14	x	101.89	x	0.63	x	0.7	=	97.77	(78)
South	0.9x	0.77	x	14.59	x	82.59	x	0.63	x	0.7	=	368.24	(78)
South	0.9x	0.77	x	3.14	x	82.59	x	0.63	x	0.7	=	79.25	(78)
South	0.9x	0.77	x	14.59	x	55.42	x	0.63	x	0.7	=	247.1	(78)
South	0.9x	0.77	x	3.14	x	55.42	x	0.63	x	0.7	=	53.18	(78)
South	0.9x	0.77	x	14.59	x	40.4	x	0.63	x	0.7	=	180.13	(78)
South	0.9x	0.77	x	3.14	x	40.4	x	0.63	x	0.7	=	38.77	(78)
Southwest	0.9x	0.77	x	21.58	x	36.79		0.63	x	0.7	=	242.66	(79)
Southwest	0.9x	0.77	x	19.86	x	36.79		0.63	x	0.7	=	223.32	(79)
Southwest	0.9x	0.77	x	21.58	x	62.67		0.63	x	0.7	=	413.34	(79)
Southwest	0.9x	0.77	x	19.86	x	62.67		0.63	x	0.7	=	380.4	(79)
Southwest	0.9x	0.77	x	21.58	x	85.75		0.63	x	0.7	=	565.55	(79)
Southwest	0.9x	0.77	x	19.86	x	85.75		0.63	x	0.7	=	520.47	(79)
Southwest	0.9x	0.77	x	21.58	x	106.25		0.63	x	0.7	=	700.74	(79)
Southwest	0.9x	0.77	x	19.86	x	106.25		0.63	x	0.7	=	644.89	(79)
Southwest	0.9x	0.77	x	21.58	x	119.01		0.63	x	0.7	=	784.89	(79)
Southwest	0.9x	0.77	x	19.86	x	119.01		0.63	x	0.7	=	722.33	(79)
Southwest	0.9x	0.77	x	21.58	x	118.15		0.63	x	0.7	=	779.21	(79)
Southwest	0.9x	0.77	x	19.86	x	118.15		0.63	x	0.7	=	717.11	(79)
Southwest	0.9x	0.77	x	21.58	x	113.91		0.63	x	0.7	=	751.25	(79)
Southwest	0.9x	0.77	x	19.86	x	113.91		0.63	x	0.7	=	691.37	(79)
Southwest	0.9x	0.77	x	21.58	x	104.39		0.63	x	0.7	=	688.47	(79)
Southwest	0.9x	0.77	x	19.86	x	104.39		0.63	x	0.7	=	633.6	(79)
Southwest	0.9x	0.77	x	21.58	x	92.85		0.63	x	0.7	=	612.37	(79)

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Southwest	0.9x	0.77	x	19.86	x	92.85		0.63	x	0.7	=	563.56	(79)
Southwest	0.9x	0.77	x	21.58	x	69.27		0.63	x	0.7	=	456.83	(79)
Southwest	0.9x	0.77	x	19.86	x	69.27		0.63	x	0.7	=	420.42	(79)
Southwest	0.9x	0.77	x	21.58	x	44.07		0.63	x	0.7	=	290.65	(79)
Southwest	0.9x	0.77	x	19.86	x	44.07		0.63	x	0.7	=	267.48	(79)
Southwest	0.9x	0.77	x	21.58	x	31.49		0.63	x	0.7	=	207.67	(79)
Southwest	0.9x	0.77	x	19.86	x	31.49		0.63	x	0.7	=	191.11	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	719.31	1208.62	1614.51	1942.94	2129.65	2095.33	2027.88	1890.44	1728	1324.74	858.41	617.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1363.41	1850.43	2234.64	2527.26	2676.03	2606.33	2516.62	2385.94	2242.53	1875.32	1450.54	1242.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.71	0.52	0.37	0.41	0.64	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.3	20.58	20.83	20.96	20.99	21	21	20.98	20.79	20.35	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.95	0.84	0.66	0.46	0.3	0.34	0.57	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.24	19.63	19.97	20.12	20.16	20.16	20.16	20.15	19.93	19.31	18.8	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.98	0.95	0.85	0.68	0.48	0.33	0.37	0.6	0.9	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1359.42	1822.08	2115.87	2144.49	1818.6	1257.64	837.2	878.35	1346.37	1689.15	1435.85	1240.29	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3294.33	3227	2947.92	2470.15	1892.44	1265.55	837.87	879.59	1374.04	2089.87	2737.27	3280.14	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6044.94	(98)
Space heating requirement in kWh/m²/year	25.54	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	1539.65	1009.74	662.08	250.78	58.76	0	0	0	0	318.86	1002.16	1623.15	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 6465.18 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	88.89	88.45	87.56	85.44	82.06	79.8	79.8	79.8	79.8	85.98	88.38	89

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	252.02	223.15	236.5	216.92	221.09	202.75	194.36	213.77	213.55	223.54	230.35	245.56

Total = Sum(219a)$_{1...12}$ = 2673.55 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		6465.18
Water heating fuel used		2673.55
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		637.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9850.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	1396.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	577.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1973.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			2343.57	(272)

TER = 14.49 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 38 Flat 38 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	843.49	**(P1)**
Transmission heat loss coefficient:	103.2	
Summer heat loss coefficient:	946.69	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SE)	0	1
South West (SW)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SE)	1	0.9	1	0.9	**(P8)**
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SE)	0.9 x	33.34	112.1	0.4	0.8	0.9	968.75	
South West (SW)	0.9 x	30.67	112.1	0.4	0.8	0.9	891.17	
South (S)	0.9 x	22.53	106.3	0.4	1	0.9	775.94	
South (S GLAZED DOOR)	0.9 x	4.85	106.3	0.4	0.7	0.9	116.93	
						Total	2752.78	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	711.52	681.97	692.71	
Total summer gains	3643.69	3434.75	3222.56	**(P5)**
Summer gain/loss ratio	3.85	3.63	3.4	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.85	21.33	21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:45

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 122.24m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.89 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.15 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	37.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.8 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.90 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: West	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 38 Flat 38 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	122.24 m²	2.7 m

Living area:	63.24 m² (fraction 0.517)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
W	16mm or more	1	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	52.72	46.1	6.62	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	45.2						N/A
PARTY CEILING	122.24						N/A
PARTY FLOOR	122.24						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0748

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	30.48	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.35	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	61.15	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 106.48 (fraction 0.871)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24	(1a) x	2.7	(2a) =	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x 1/[1/(1)+ 0.04]		=	9.31			(27)
Windows Type 2			11.79	x 1/[1/(1)+ 0.04]		=	11.34			(27)
Windows Type 3			1.59	x 1/[1/(1)+ 0.04]		=	1.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 5			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 6			16.35	x 1/[1/(1)+ 0.04]		=	15.72			(27)
Windows Type 7			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Walls	52.72	46.1	6.62	x	0.24	=	1.59			(29)
Total area of elements, m²			52.72							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			45.2	x	0	=	0			(32)
Party floor			122.24							(32a)
Party ceiling			122.24							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25416.49 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 3.94 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 49.86 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.7	39.18	38.65	36.01	35.48	32.84	32.84	32.32	33.9	35.48	36.54	37.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.56	89.03	88.51	85.87	85.34	82.7	82.7	82.18	83.76	85.34	86.4	87.45	

Average = Sum(39)$_{1...12}$ /12= | 85.74 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.69	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= | 0.7 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.87 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 102.4 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = | 1228.8 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = | 1611.15 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 190 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 1.61 | (48)

Temperature factor from Table 2b | 0.6 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.97 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Output from water heater (annual)$_{1...12}$ — 1963.74 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.5	70.22	74.08	66.89	65.89	59.37	57.49	62.43	62.12	69.33	72.72	77.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	64.21	57.03	46.38	35.11	26.25	22.16	23.94	31.12	41.77	53.04	61.91	66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	430	434.46	423.22	399.28	369.06	340.67	321.69	317.23	328.47	352.41	382.63	411.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	106.85	104.49	99.57	92.9	88.56	82.46	77.27	83.92	86.28	93.19	100.99	104.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	713.6	708.52	681.71	639.83	596.41	557.81	535.44	544.8	569.06	611.18	658.06	694.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
Southeast 0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast 0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast 0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)

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Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	16.35	x	19.64	x	0.4	x	1	=	89.01	(80)
West	0.9x	0.77	x	16.35	x	38.42	x	0.4	x	1	=	174.13	(80)
West	0.9x	0.77	x	16.35	x	63.27	x	0.4	x	1	=	286.77	(80)
West	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	1	=	418.23	(80)
West	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	1	=	512.56	(80)
West	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	1	=	524.7	(80)
West	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	1	=	499.53	(80)
West	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	1	=	429.09	(80)

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West	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	1	=	333.52	(80)
West	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	1	=	206.62	(80)
West	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	1	=	110.99	(80)
West	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	1	=	73.2	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	251.24	459.43	702.65	979.02	1184.18	1211.12	1153.1	996.62	798.88	528.66	306.89	211.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.83	1167.95	1384.36	1618.85	1780.59	1768.93	1688.54	1541.42	1367.94	1139.84	964.95	905.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.85	0.75	0.59	0.43	0.3	0.21	0.24	0.41	0.68	0.86	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.25	20.58	20.85	20.96	20.99	21	21	20.98	20.8	20.36	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.33	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.84	0.73	0.56	0.4	0.27	0.18	0.21	0.38	0.65	0.84	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.33	19.79	20.16	20.3	20.35	20.36	20.36	20.33	20.11	19.5	18.86	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.83	0.73	0.57	0.42	0.28	0.2	0.23	0.39	0.65	0.83	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	858.27	965.6	1005.23	924.06	742.83	499.95	337.63	351.58	538.38	745.71	805.49	817.39	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1356.33	1327.07	1212.24	997.74	762.95	503.24	338.29	352.65	549.79	842.04	1109.9	1329.71	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1507.51 (98)

Space heating requirement in kWh/m²/year 12.33 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	777.41	612	624.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	762.73	605.78	615.42	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1973.41	1883.21	1709.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	871.69	950.41	814.13	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 2636.23 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	189.83	206.97	177.29	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ = 574.09 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.7 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	217.97	142.88	90.6	31.21	8.81	0	0	0	0	42.16	128.93	224.22	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 886.77 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72

Efficiency of water heater 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Total = Sum(219a)$_{1...12}$ = 1963.74 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	31.96	34.84	29.85	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 96.65 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		886.77	
Water heating fuel used		1963.74	
Space cooling fuel used		96.65	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	372.46		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		372.46	(231)
Electricity for lighting		453.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3773.21	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	116.96	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	259.02	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	12.75	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	49.13	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.83	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost (245)...(247) + (250)…(254) =					497.69	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.25	(257)
SAP rating (Section 12)		82.56	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	460.23	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1019.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1479.41	(265)
Space cooling	(221) x		0.519	=	50.16	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	193.31	(267)
Electricity for lighting	(232) x		0.519	=	235.42	(268)
Total CO2, kg/year		sum of (265)…(271) =			1958.3	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.02	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2722.38	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6028.67	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8751.06	(265)
Space cooling	(221) x		3.07	=	296.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	1143.45	(267)
Electricity for lighting	(232) x		0	=	1392.54	(268)
'Total Primary Energy		sum of (265)…(271) =			11583.75	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			94.76	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 38 Flat 38 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24	(1a) x	2.7	(2a) =	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.42	x1/[1/(1.5)+ 0.04] =	9.08			(27)
Windows Type 2			7.82	x1/[1/(1.5)+ 0.04] =	11.07			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 5			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 6			10.84	x1/[1/(1.5)+ 0.04] =	15.34			(27)
Windows Type 7			1.04	x1/[1/(1.5)+ 0.04] =	1.47			(27)
Walls	52.72	30.57	22.15	x 0.18 =	3.99			(29)
Total area of elements, m²			52.72					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			45.2	x 0 =	0			(32)
Party floor			122.24					(32a)
Party ceiling			122.24					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25633.91 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.78	61.5	61.22	59.91	59.67	58.53	58.53	58.31	58.96	59.67	60.16	60.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.77	112.48	112.2	110.89	110.65	109.51	109.51	109.3	109.95	110.65	111.14	111.66	

Average = Sum(39)$_{1...12}$ /12= 110.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.91	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.4 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = 1228.8 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = 1611.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Output from water heater (annual)$_{1...12}$ 2200.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.61	84.77	90.2	82.48	82.01	74.97	73.6	78.55	77.72	85.45	88.31	93.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.68	22.81	18.55	14.05	10.5	8.86	9.58	12.45	16.71	21.22	24.76	26.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	288.1	291.09	283.56	267.52	247.27	228.25	215.53	212.54	220.08	236.12	256.36	275.39	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	128.51	126.15	121.24	114.56	110.22	104.12	98.93	105.58	107.94	114.85	122.66	126.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	511.37	509.13	492.42	465.2	437.07	410.3	393.12	399.65	413.8	441.26	472.86	497.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North 0.9x	0.77	x	1.04	x	10.63	x	0.63	x	0.7	=	3.38	(74)
North 0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North 0.9x	0.77	x	1.04	x	20.32	x	0.63	x	0.7	=	6.46	(74)
North 0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North 0.9x	0.77	x	1.04	x	34.53	x	0.63	x	0.7	=	10.98	(74)
North 0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North 0.9x	0.77	x	1.04	x	55.46	x	0.63	x	0.7	=	17.63	(74)
North 0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North 0.9x	0.77	x	1.04	x	74.72	x	0.63	x	0.7	=	23.75	(74)
North 0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North 0.9x	0.77	x	1.04	x	79.99	x	0.63	x	0.7	=	25.42	(74)
North 0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North 0.9x	0.77	x	1.04	x	74.68	x	0.63	x	0.7	=	23.74	(74)
North 0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North 0.9x	0.77	x	1.04	x	59.25	x	0.63	x	0.7	=	18.83	(74)
North 0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North 0.9x	0.77	x	1.04	x	41.52	x	0.63	x	0.7	=	13.2	(74)
North 0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North 0.9x	0.77	x	1.04	x	24.19	x	0.63	x	0.7	=	7.69	(74)
North 0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North 0.9x	0.77	x	1.04	x	13.12	x	0.63	x	0.7	=	4.17	(74)
North 0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North 0.9x	0.77	x	1.04	x	8.86	x	0.63	x	0.7	=	2.82	(74)
Northeast 0.9x	0.77	x	7.82	x	11.28	x	0.63	x	0.7	=	26.97	(75)
Northeast 0.9x	0.77	x	7.82	x	22.97	x	0.63	x	0.7	=	54.89	(75)
Northeast 0.9x	0.77	x	7.82	x	41.38	x	0.63	x	0.7	=	98.89	(75)
Northeast 0.9x	0.77	x	7.82	x	67.96	x	0.63	x	0.7	=	162.41	(75)
Northeast 0.9x	0.77	x	7.82	x	91.35	x	0.63	x	0.7	=	218.31	(75)
Northeast 0.9x	0.77	x	7.82	x	97.38	x	0.63	x	0.7	=	232.74	(75)
Northeast 0.9x	0.77	x	7.82	x	91.1	x	0.63	x	0.7	=	217.72	(75)
Northeast 0.9x	0.77	x	7.82	x	72.63	x	0.63	x	0.7	=	173.57	(75)
Northeast 0.9x	0.77	x	7.82	x	50.42	x	0.63	x	0.7	=	120.5	(75)
Northeast 0.9x	0.77	x	7.82	x	28.07	x	0.63	x	0.7	=	67.08	(75)
Northeast 0.9x	0.77	x	7.82	x	14.2	x	0.63	x	0.7	=	33.93	(75)
Northeast 0.9x	0.77	x	7.82	x	9.21	x	0.63	x	0.7	=	22.02	(75)
Southeast 0.9x	0.77	x	6.42	x	36.79	x	0.63	x	0.7	=	72.19	(77)
Southeast 0.9x	0.77	x	6.42	x	62.67	x	0.63	x	0.7	=	122.97	(77)
Southeast 0.9x	0.77	x	6.42	x	85.75	x	0.63	x	0.7	=	168.25	(77)

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Southeast	0.9x	0.77	x	6.42	x	106.25	x	0.63	x	0.7	=	208.47	(77)
Southeast	0.9x	0.77	x	6.42	x	119.01	x	0.63	x	0.7	=	233.5	(77)
Southeast	0.9x	0.77	x	6.42	x	118.15	x	0.63	x	0.7	=	231.81	(77)
Southeast	0.9x	0.77	x	6.42	x	113.91	x	0.63	x	0.7	=	223.49	(77)
Southeast	0.9x	0.77	x	6.42	x	104.39	x	0.63	x	0.7	=	204.82	(77)
Southeast	0.9x	0.77	x	6.42	x	92.85	x	0.63	x	0.7	=	182.18	(77)
Southeast	0.9x	0.77	x	6.42	x	69.27	x	0.63	x	0.7	=	135.91	(77)
Southeast	0.9x	0.77	x	6.42	x	44.07	x	0.63	x	0.7	=	86.47	(77)
Southeast	0.9x	0.77	x	6.42	x	31.49	x	0.63	x	0.7	=	61.78	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.7	x	46.75	x	0.63	x	0.7	=	24.29	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.7	x	76.57	x	0.63	x	0.7	=	39.78	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.7	x	97.53	x	0.63	x	0.7	=	50.67	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.7	x	110.23	x	0.63	x	0.7	=	57.27	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.7	x	114.87	x	0.63	x	0.7	=	59.68	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.7	x	110.55	x	0.63	x	0.7	=	57.43	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.7	x	108.01	x	0.63	x	0.7	=	56.12	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.7	x	104.89	x	0.63	x	0.7	=	54.5	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.7	x	101.89	x	0.63	x	0.7	=	52.93	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.7	x	82.59	x	0.63	x	0.7	=	42.91	(78)
South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.7	x	55.42	x	0.63	x	0.7	=	28.79	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.7	x	40.4	x	0.63	x	0.7	=	20.99	(78)
West	0.9x	0.77	x	10.84	x	19.64	x	0.63	x	0.7	=	65.07	(80)
West	0.9x	0.77	x	10.84	x	38.42	x	0.63	x	0.7	=	127.28	(80)
West	0.9x	0.77	x	10.84	x	63.27	x	0.63	x	0.7	=	209.61	(80)
West	0.9x	0.77	x	10.84	x	92.28	x	0.63	x	0.7	=	305.71	(80)
West	0.9x	0.77	x	10.84	x	113.09	x	0.63	x	0.7	=	374.66	(80)
West	0.9x	0.77	x	10.84	x	115.77	x	0.63	x	0.7	=	383.53	(80)
West	0.9x	0.77	x	10.84	x	110.22	x	0.63	x	0.7	=	365.14	(80)
West	0.9x	0.77	x	10.84	x	94.68	x	0.63	x	0.7	=	313.65	(80)

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West	0.9x	0.77	x	10.84	x	73.59	x	0.63	x	0.7	=	243.79	(80)
West	0.9x	0.77	x	10.84	x	45.59	x	0.63	x	0.7	=	151.03	(80)
West	0.9x	0.77	x	10.84	x	24.49	x	0.63	x	0.7	=	81.13	(80)
West	0.9x	0.77	x	10.84	x	16.15	x	0.63	x	0.7	=	53.51	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	212.42	386.5	587.64	815.68	985.58	1007.97	959.66	829.8	666.86	443.68	259.08	178.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	723.79	895.63	1080.06	1280.87	1422.65	1418.27	1352.78	1229.45	1080.66	884.94	731.94	675.7	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.69	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.26	20.54	20.83	20.96	21	21	21	20.98	20.75	20.34	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.18	19.57	19.97	20.13	20.17	20.17	20.17	20.15	19.88	19.31	18.85	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	721.46	885.79	1036.82	1098.75	946.96	653.63	437.7	458.38	692.61	821.73	725.54	674.21	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1714.5	1668.99	1522.63	1276.68	980.68	656.7	437.98	459.03	712.35	1076.43	1416.28	1704.56	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3233.19 (98)

Space heating requirement in kWh/m²/year 26.45 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
790.19	562.9	386.57	137.02	26.83	0	0	0	0	202.67	531.91	819.87	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3457.96 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Efficiency of water heater 79.8 (216)

(217)m=	87.83	87.38	86.36	83.93	80.99	79.8	79.8	79.8	79.8	84.86	87.18	87.95

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	247.23	218.98	232.56	214.36	217.56	197.12	189.14	207.78	207.49	219.86	226.48	240.9	

Total = Sum(219a)$_{1...12}$ = 2619.48 (219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1		3457.96
Water heating fuel used		2619.48
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		453.6 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6606.04 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	746.92	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.81	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1312.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	235.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.07	(272)

TER = 18.89 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 38 Flat 38 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	435.66	**(P1)**
Transmission heat loss coefficient:	49.9	
Summer heat loss coefficient:	485.52	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
West (W)	0	1
North (N)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
West (W)	0.9 x	16.35	108.47	0.4	1	0.9	574.6	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1326.38	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	557.81	535.44	544.8	
Total summer gains	1994.64	1861.82	1672.58	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	4.11	3.83	3.44	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.11	21.53	21.04	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:40

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 218.74m²

Site Reference : P1785 St Michaels

Plot Reference: Level 39 Flat 39 01

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.54 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.60 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	41.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.85 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	33.34m²
Windows facing: North East	31.09m²
Windows facing: North	22.53m²
Windows facing: North	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 39 Flat 39 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	218.74 m²	2.7 m

Living area:	99.26 m² (fraction 0.454)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	33.34	1
NE	16mm or more	0.8	0.4	1	31.09	1
N	16mm or more	1	0.4	1	22.53	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
NE		OPAQUE CURT WALL	North East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	115.29	91.81	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	354.24						N/A
Party Elements							
PARTY WALLS	40.89						N/A
WALLS TO CORRIDOR	40.3						N/A
PARTY CEILING	218.74						N/A

SAP Input

PARTY FLOOR 218.74 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0844

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.58	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 1
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 167.89 (fraction 0.768)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.23 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			31.09	x 1/[1/(1)+ 0.04]		=	29.89			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	115.29	91.81	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			115.29							(31)
Party wall			40.89	x	0	=	0			(32)
Party wall			40.3	x	0	=	0			(32)
Party floor			218.74							(32a)
Party ceiling			218.74							(32b)
Internal wall **			354.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 44513.88 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	80.36	79.24	78.11	72.48	71.35	65.72	65.72	64.59	67.97	71.35	73.6	75.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	184	182.88	181.75	176.12	174.99	169.36	169.36	168.23	171.61	174.99	177.24	179.5	

Average = Sum(39)$_{1...12}$ /12= 175.84 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.83	0.81	0.8	0.77	0.77	0.77	0.78	0.8	0.81	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	

Output from water heater (annual)$_{1...12}$ — 2021.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.49	71.96	75.88	68.45	67.39	60.67	58.69	63.81	63.52	70.96	74.49	79.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	86.59	76.91	62.55	47.35	35.4	29.88	32.29	41.97	56.34	71.53	83.49	89	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	579.89	585.91	570.74	538.46	497.71	459.41	433.82	427.81	442.97	475.25	516	554.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	109.53	107.08	101.99	95.08	90.58	84.26	78.89	85.77	88.22	95.38	103.46	107.09	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	892.72	886.61	851.99	797.6	740.4	690.26	661.71	672.26	704.24	758.87	819.66	867.1	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	22.53	x	10.63	x	0.4	x	1	=	66.41	(74)
North	0.9x	0.77	x	4.85	x	10.63	x	0.4	x	0.7	=	10.01	(74)
North	0.9x	0.77	x	22.53	x	20.32	x	0.4	x	1	=	126.91	(74)
North	0.9x	0.77	x	4.85	x	20.32	x	0.4	x	0.7	=	19.12	(74)
North	0.9x	0.77	x	22.53	x	34.53	x	0.4	x	1	=	215.65	(74)
North	0.9x	0.77	x	4.85	x	34.53	x	0.4	x	0.7	=	32.5	(74)
North	0.9x	0.77	x	22.53	x	55.46	x	0.4	x	1	=	346.39	(74)
North	0.9x	0.77	x	4.85	x	55.46	x	0.4	x	0.7	=	52.2	(74)
North	0.9x	0.77	x	22.53	x	74.72	x	0.4	x	1	=	466.62	(74)
North	0.9x	0.77	x	4.85	x	74.72	x	0.4	x	0.7	=	70.31	(74)
North	0.9x	0.77	x	22.53	x	79.99	x	0.4	x	1	=	499.53	(74)
North	0.9x	0.77	x	4.85	x	79.99	x	0.4	x	0.7	=	75.27	(74)
North	0.9x	0.77	x	22.53	x	74.68	x	0.4	x	1	=	466.38	(74)
North	0.9x	0.77	x	4.85	x	74.68	x	0.4	x	0.7	=	70.28	(74)
North	0.9x	0.77	x	22.53	x	59.25	x	0.4	x	1	=	370.01	(74)
North	0.9x	0.77	x	4.85	x	59.25	x	0.4	x	0.7	=	55.76	(74)
North	0.9x	0.77	x	22.53	x	41.52	x	0.4	x	1	=	259.28	(74)
North	0.9x	0.77	x	4.85	x	41.52	x	0.4	x	0.7	=	39.07	(74)
North	0.9x	0.77	x	22.53	x	24.19	x	0.4	x	1	=	151.07	(74)
North	0.9x	0.77	x	4.85	x	24.19	x	0.4	x	0.7	=	22.76	(74)
North	0.9x	0.77	x	22.53	x	13.12	x	0.4	x	1	=	81.92	(74)
North	0.9x	0.77	x	4.85	x	13.12	x	0.4	x	0.7	=	12.34	(74)
North	0.9x	0.77	x	22.53	x	8.86	x	0.4	x	1	=	55.36	(74)
North	0.9x	0.77	x	4.85	x	8.86	x	0.4	x	0.7	=	8.34	(74)
Northeast	0.9x	0.77	x	31.09	x	11.28	x	0.4	x	0.8	=	77.79	(75)
Northeast	0.9x	0.77	x	31.09	x	22.97	x	0.4	x	0.8	=	158.34	(75)
Northeast	0.9x	0.77	x	31.09	x	41.38	x	0.4	x	0.8	=	285.29	(75)
Northeast	0.9x	0.77	x	31.09	x	67.96	x	0.4	x	0.8	=	468.52	(75)
Northeast	0.9x	0.77	x	31.09	x	91.35	x	0.4	x	0.8	=	629.79	(75)
Northeast	0.9x	0.77	x	31.09	x	97.38	x	0.4	x	0.8	=	671.42	(75)
Northeast	0.9x	0.77	x	31.09	x	91.1	x	0.4	x	0.8	=	628.1	(75)
Northeast	0.9x	0.77	x	31.09	x	72.63	x	0.4	x	0.8	=	500.73	(75)
Northeast	0.9x	0.77	x	31.09	x	50.42	x	0.4	x	0.8	=	347.63	(75)
Northeast	0.9x	0.77	x	31.09	x	28.07	x	0.4	x	0.8	=	193.51	(75)
Northeast	0.9x	0.77	x	31.09	x	14.2	x	0.4	x	0.8	=	97.88	(75)
Northeast	0.9x	0.77	x	31.09	x	9.21	x	0.4	x	0.8	=	63.53	(75)
Northwest	0.9x	0.77	x	33.34	x	11.28	x	0.4	x	0.8	=	83.42	(81)
Northwest	0.9x	0.77	x	33.34	x	22.97	x	0.4	x	0.8	=	169.8	(81)
Northwest	0.9x	0.77	x	33.34	x	41.38	x	0.4	x	0.8	=	305.93	(81)
Northwest	0.9x	0.77	x	33.34	x	67.96	x	0.4	x	0.8	=	502.43	(81)
Northwest	0.9x	0.77	x	33.34	x	91.35	x	0.4	x	0.8	=	675.36	(81)

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Northwest	0.9x	0.77	x	33.34	x	97.38	x	0.4	x	0.8	=	720.01	(81)
Northwest	0.9x	0.77	x	33.34	x	91.1	x	0.4	x	0.8	=	673.55	(81)
Northwest	0.9x	0.77	x	33.34	x	72.63	x	0.4	x	0.8	=	536.97	(81)
Northwest	0.9x	0.77	x	33.34	x	50.42	x	0.4	x	0.8	=	372.78	(81)
Northwest	0.9x	0.77	x	33.34	x	28.07	x	0.4	x	0.8	=	207.51	(81)
Northwest	0.9x	0.77	x	33.34	x	14.2	x	0.4	x	0.8	=	104.96	(81)
Northwest	0.9x	0.77	x	33.34	x	9.21	x	0.4	x	0.8	=	68.13	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	237.63	474.18	839.37	1369.54	1842.09	1966.24	1838.31	1463.46	1018.77	574.86	297.11	195.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1130.35	1360.79	1691.36	2167.14	2582.49	2656.5	2500.02	2135.72	1723	1333.73	1116.78	1062.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.9	0.76	0.57	0.4	0.29	0.35	0.61	0.87	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.2	19.49	19.98	20.55	20.86	20.97	20.99	20.99	20.88	20.39	19.71	19.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.23	20.25	20.25	20.28	20.28	20.28	20.27	20.25	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.89	0.74	0.54	0.35	0.25	0.3	0.56	0.85	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.76	18.19	18.89	19.7	20.1	20.25	20.27	20.27	20.14	19.5	18.53	17.75	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.87	0.73	0.54	0.37	0.27	0.33	0.58	0.84	0.94	0.97	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1084.44	1269.12	1471.42	1581.21	1407.26	988.03	671.12	694.65	993.53	1117.84	1048.06	1025.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2596.98	2538.45	2341.19	1970.13	1530.08	1012.11	677.01	705.57	1094.31	1627.57	2120.42	2548.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5280.94	(98)
Space heating requirement in kWh/m²/year	24.14	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1591.95	1253.24	1278.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.96	0.94	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1498.19	1207.04	1202.66	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2988.46	2810.38	2382.8	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1072.99	1192.89	878.03	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	3143.91	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.77	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	205.89	228.9	168.48	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	603.26	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	2.76	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	661.96	501.76	380.65	164.72	53.75	0	0	0	0	223.08	454.17	666.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	3106.43	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Total = Sum(219a)$_{1...12}$ = 2021.55 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	34.66	38.53	28.36	0	0	0	0

Total = Sum(221)$_{6...8}$ = 101.56 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3106.43
Water heating fuel used		2021.55
Space cooling fuel used		101.56
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	666.49	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		666.49 (231)
Electricity for lighting		611.71 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6507.74 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	409.74 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	266.64 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.4 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	87.91 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	80.68 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		858.37 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.93	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	1612.24	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1049.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2661.43	(265)
Space cooling	(221) x		0.519	=	52.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	345.91	(267)
Electricity for lighting	(232) x		0.519	=	317.48	(268)
Total CO2, kg/year		sum of (265)…(271) =			3377.52	(272)
CO2 emissions per m²		(272) ÷ (4) =			15.44	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	9536.75	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6206.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				15742.92	(265)
Space cooling	(221) x		3.07	=	311.79	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	2046.12	(267)
Electricity for lighting	(232) x		0	=	1877.94	(268)
'Total Primary Energy		sum of (265)…(271) =			19978.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			91.34	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.07	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.32	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 2			18.52	x1/[1/(1.5)+ 0.04] =	26.21			(27)
Windows Type 3			13.42	x1/[1/(1.5)+ 0.04] =	18.99			(27)
Windows Type 4			2.89	x1/[1/(1.5)+ 0.04] =	4.09			(27)
Walls	115.29	54.69	60.6	x 0.18 =	10.91			(29)
Total area of elements, m²			115.29					(31)
Party wall			40.89	x 0 =	0			(32)
Party wall			40.3	x 0 =	0			(32)
Party floor			218.74					(32a)
Party ceiling			218.74					(32b)
Internal wall **			354.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 88.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 45033.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.5 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 97.8 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	111.13	110.6	110.08	107.63	107.18	105.05	105.05	104.65	105.87	107.18	108.1	109.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	208.94	208.4	207.88	205.44	204.98	202.85	202.85	202.45	203.67	204.98	205.91	206.87	

Average = Sum(39)$_{1...12}$ /12= 205.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	

Output from water heater (annual)$_{1...12}$ — 2258.75 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.61	86.52	92	84.05	83.51	76.26	74.81	79.93	79.11	87.08	90.09	95.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	34.64	30.76	25.02	18.94	14.16	11.95	12.92	16.79	22.53	28.61	33.39	35.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	388.52	392.56	382.4	360.77	333.47	307.81	290.66	286.63	296.79	318.42	345.72	371.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	131.19	128.74	123.65	116.74	112.25	105.92	100.55	107.43	109.88	117.04	125.13	128.75	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	625.75	623.46	602.47	567.84	531.27	497.08	475.52	482.25	500.6	535.47	575.64	607.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	13.42	x	10.63	x	0.63	x	0.7	=	43.61	(74)
North	0.9x	0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x	0.77	x	13.42	x	20.32	x	0.63	x	0.7	=	83.34	(74)
North	0.9x	0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x	0.77	x	13.42	x	34.53	x	0.63	x	0.7	=	141.62	(74)
North	0.9x	0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x	0.77	x	13.42	x	55.46	x	0.63	x	0.7	=	227.48	(74)
North	0.9x	0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x	0.77	x	13.42	x	74.72	x	0.63	x	0.7	=	306.43	(74)
North	0.9x	0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x	0.77	x	13.42	x	79.99	x	0.63	x	0.7	=	328.05	(74)
North	0.9x	0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x	0.77	x	13.42	x	74.68	x	0.63	x	0.7	=	306.27	(74)
North	0.9x	0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	13.42	x	59.25	x	0.63	x	0.7	=	242.99	(74)
North	0.9x	0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x	0.77	x	13.42	x	41.52	x	0.63	x	0.7	=	170.27	(74)
North	0.9x	0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x	0.77	x	13.42	x	24.19	x	0.63	x	0.7	=	99.21	(74)
North	0.9x	0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x	0.77	x	13.42	x	13.12	x	0.63	x	0.7	=	53.8	(74)
North	0.9x	0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x	0.77	x	13.42	x	8.86	x	0.63	x	0.7	=	36.36	(74)
North	0.9x	0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
Northeast	0.9x	0.77	x	18.52	x	11.28	x	0.63	x	0.7	=	63.86	(75)
Northeast	0.9x	0.77	x	18.52	x	22.97	x	0.63	x	0.7	=	129.99	(75)
Northeast	0.9x	0.77	x	18.52	x	41.38	x	0.63	x	0.7	=	234.2	(75)
Northeast	0.9x	0.77	x	18.52	x	67.96	x	0.63	x	0.7	=	384.63	(75)
Northeast	0.9x	0.77	x	18.52	x	91.35	x	0.63	x	0.7	=	517.01	(75)
Northeast	0.9x	0.77	x	18.52	x	97.38	x	0.63	x	0.7	=	551.19	(75)
Northeast	0.9x	0.77	x	18.52	x	91.1	x	0.63	x	0.7	=	515.63	(75)
Northeast	0.9x	0.77	x	18.52	x	72.63	x	0.63	x	0.7	=	411.06	(75)
Northeast	0.9x	0.77	x	18.52	x	50.42	x	0.63	x	0.7	=	285.38	(75)
Northeast	0.9x	0.77	x	18.52	x	28.07	x	0.63	x	0.7	=	158.86	(75)
Northeast	0.9x	0.77	x	18.52	x	14.2	x	0.63	x	0.7	=	80.35	(75)
Northeast	0.9x	0.77	x	18.52	x	9.21	x	0.63	x	0.7	=	52.15	(75)
Northwest	0.9x	0.77	x	19.86	x	11.28	x	0.63	x	0.7	=	68.48	(81)
Northwest	0.9x	0.77	x	19.86	x	22.97	x	0.63	x	0.7	=	139.4	(81)
Northwest	0.9x	0.77	x	19.86	x	41.38	x	0.63	x	0.7	=	251.15	(81)
Northwest	0.9x	0.77	x	19.86	x	67.96	x	0.63	x	0.7	=	412.46	(81)
Northwest	0.9x	0.77	x	19.86	x	91.35	x	0.63	x	0.7	=	554.42	(81)

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Northwest	0.9x	0.77	x	19.86	x	97.38	x	0.63	x	0.7	=	591.07	(81)
Northwest	0.9x	0.77	x	19.86	x	91.1	x	0.63	x	0.7	=	552.94	(81)
Northwest	0.9x	0.77	x	19.86	x	72.63	x	0.63	x	0.7	=	440.81	(81)
Northwest	0.9x	0.77	x	19.86	x	50.42	x	0.63	x	0.7	=	306.03	(81)
Northwest	0.9x	0.77	x	19.86	x	28.07	x	0.63	x	0.7	=	170.35	(81)
Northwest	0.9x	0.77	x	19.86	x	14.2	x	0.63	x	0.7	=	86.17	(81)
Northwest	0.9x	0.77	x	19.86	x	9.21	x	0.63	x	0.7	=	55.93	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.35	370.68	657.47	1073.55	1443.86	1540.95	1440.79	1147.19	798.35	449.79	231.91	152.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	811.09	994.14	1259.93	1641.39	1975.12	2038.03	1916.31	1629.44	1298.95	985.25	807.54	759.39	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.97	0.84	0.62	0.46	0.56	0.89	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.95	20.22	20.6	20.89	20.99	21	20.99	20.89	20.49	20.08	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.13	20.14	20.14	20.14	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.96	0.79	0.54	0.37	0.46	0.83	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.7	19.09	19.65	20.03	20.13	20.14	20.14	20.04	19.5	18.91	18.47	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.81	0.58	0.41	0.51	0.85	0.99	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	810.85	993.1	1252.57	1570.68	1599.7	1179.74	794.99	828.47	1108.12	975.94	806.92	759.24	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3090.25	2994.2	2724.06	2297.4	1787.46	1201.01	797.43	835.95	1288.49	1915.57	2540.88	3076.16	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8469.65	(98)
Space heating requirement in kWh/m²/year	38.72	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
1813.76	1438.22	1170.89	559.62	149.4	0	0	0	0	747.69	1335.24	1843.62	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	9058.45	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	
Efficiency of water heater												79.8	(216)
(217)m=	89.11	88.98	88.62	87.44	84.14	79.8	79.8	79.8	79.8	87.96	88.84	89.16	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	250.39	220.93	232.76	211.14	214.81	202.02	193.68	212.99	212.76	217.66	228.28	244.13	
Total = Sum(219a)$_{1...12}$ =												2641.53	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		9058.45	
Water heating fuel used		2641.53	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		611.71	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		12386.69	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	1956.63	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	570.57	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2527.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	317.48	(268)
Total CO2, kg/year	sum of (265)…(271) =			2883.6	(272)

TER = 19.54 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 39 Flat 39 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	779.59	**(P1)**
Transmission heat loss coefficient:	103.6	
Summer heat loss coefficient:	883.23	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North West (NW)	0	1
North East (NE)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North West (NW)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
North West (NW)	0.9 x	33.34	89.66	0.4	0.8	0.9	774.78	
North East (NE)	0.9 x	31.09	89.66	0.4	0.8	0.9	722.49	
North (N)	0.9 x	22.53	73.49	0.4	1	0.9	536.47	
North (N GLAZED DOOR)	0.9 x	4.85	73.49	0.4	0.7	0.9	80.84	
						Total	2114.57	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	690.26	661.71	672.26	
Total summer gains	3022.94	2776.28	2328.33	**(P5)**
Summer gain/loss ratio	3.42	3.14	2.64	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.42	20.84	20.24	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Not significant**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:34

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 121.32m²

Site Reference : P1785 St Michaels

Plot Reference: Level 39 Flat 39 02

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.47 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.61 kWh/day	
	Permitted by DBSCG: 2.17 kWh/day	**OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: East	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 39 Flat 39 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2022	
Floor Location:	Floor area:	Storey height:
Floor 0	121.32 m²	2.7 m
Living area:	62.23 m² (fraction 0.513)	
Front of dwelling faces:	West	

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	0.8	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	55.49	46.1	9.39	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	44.87						N/A
PARTY CEILING	121.32						N/A
PARTY FLOOR	121.32						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0736

	Length	Psi-value		
[Approved]	28.1	0.05	E4	Jamb
[Approved]	30.74	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.25	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.91	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 105.55 (fraction 0.870)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32	(1a) x	2.7	(2a) =	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x	1/[1/(1)+ 0.04]	=	9.31			(27)
Windows Type 2			11.79	x	1/[1/(1)+ 0.04]	=	11.34			(27)
Windows Type 3			1.59	x	1/[1/(1)+ 0.04]	=	1.53			(27)
Windows Type 4			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 5			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 6			16.35	x	1/[1/(1)+ 0.04]	=	15.72			(27)
Windows Type 7			1.57	x	1/[1/(1)+ 0.04]	=	1.51			(27)
Walls	55.49	46.1	9.39	x	0.24	=	2.25			(29)
Total area of elements, m²			55.49							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			44.87	x	0	=	0			(32)
Party floor			121.32							(32a)
Party ceiling			121.32							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.58 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25283.07 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 4.09 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.4	38.88	38.36	35.74	35.22	32.6	32.6	32.07	33.64	35.22	36.26	37.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.07	89.55	89.02	86.41	85.88	83.26	83.26	82.74	84.31	85.88	86.93	87.98	

Average = Sum(39)$_{1...12}$ /12= 86.27 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.69	0.69	0.68	0.69	0.71	0.72	0.73	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.61 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Output from water heater (annual)$_{1...12}$ — 1962.51 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.46	70.18	74.05	66.85	65.86	59.34	57.46	62.4	62.09	69.3	72.68	77.7	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	63.95	56.8	46.19	34.97	26.14	22.07	23.85	31	41.6	52.82	61.65	65.73	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	428.24	432.69	421.49	397.65	367.55	339.27	320.38	315.93	327.13	350.97	381.06	409.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	106.8	104.43	99.52	92.85	88.52	82.42	77.23	83.88	86.24	93.14	100.94	104.44	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	711.43	706.36	679.65	637.91	594.66	556.2	533.9	543.25	567.41	609.38	656.1	691.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
East 0.9x	0.77	x	16.35	x	19.64	x	0.4	x	0.8	=	71.21	(76)
East 0.9x	0.77	x	16.35	x	38.42	x	0.4	x	0.8	=	139.3	(76)
East 0.9x	0.77	x	16.35	x	63.27	x	0.4	x	0.8	=	229.41	(76)

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East	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	0.8	=	334.59	(76)
East	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	0.8	=	410.05	(76)
East	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	0.8	=	419.76	(76)
East	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	0.8	=	399.63	(76)
East	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	0.8	=	343.27	(76)
East	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	0.8	=	266.82	(76)
East	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	0.8	=	165.3	(76)
East	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	0.8	=	88.79	(76)
East	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	0.8	=	58.56	(76)
Southeast	0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast	0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast	0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)
Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)

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South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	233.43	424.61	645.3	895.38	1081.67	1106.18	1053.19	910.8	732.17	487.34	284.69	196.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	944.86	1130.97	1324.94	1533.29	1676.33	1662.38	1587.09	1454.05	1299.59	1096.72	940.79	888.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.86	0.77	0.62	0.46	0.32	0.23	0.26	0.43	0.7	0.87	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.78	20.32	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.31	20.31	20.33	20.33	20.35	20.35	20.36	20.35	20.33	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.85	0.75	0.59	0.43	0.29	0.2	0.22	0.4	0.67	0.85	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.84	19.25	19.71	20.12	20.28	20.34	20.35	20.35	20.32	20.07	19.44	18.8	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.84	0.74	0.6	0.44	0.3	0.21	0.24	0.41	0.67	0.84	0.91	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	844.34	945.75	985.21	913.63	741	501.55	339.07	353.02	538.27	736.67	792.25	805.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1358.7	1328.54	1213.65	1000.63	766.21	505.89	339.96	354.44	552.33	844.33	1112.16	1332.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1594.2 (98)

Space heating requirement in kWh/m²/year 13.14 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	782.68	616.15	628.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	763.57	607.91	616.98	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1849.14	1764.9	1607.82	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	781.61	860.8	737.18	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 2379.6 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	170	187.23	160.34	0	0	0	0	

Total = Sum(107)$_{6...8}$ = 517.57 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.27 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	225.11	151.31	99.97	36.85	11.03	0	0	0	0	47.12	135.49	230.88	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 937.77 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59

Efficiency of water heater — 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Total = Sum(219a)$_{1...12}$ = 1962.51 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	28.62	31.52	26.99	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 87.13 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.77	
Water heating fuel used		1962.51	
Space cooling fuel used		87.13	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	369.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	369.66	(231)
Electricity for lighting		451.74	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3808.8	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	123.69	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	258.85	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.49	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	48.76	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.58	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				502.38	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.3	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.7	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1018.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1505.24	(265)
Space cooling	(221)	x	0.519	=	45.22	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	191.85	(267)
Electricity for lighting	(232)	x	0.519	=	234.45	(268)
Total CO2, kg/year		sum of (265)…(271) =			1976.77	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.29	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2878.94	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6024.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8903.83	(265)
Space cooling	(221)	x	3.07	=	267.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	1134.84	(267)
Electricity for lighting	(232)	x	0	=	1386.84	(268)
'Total Primary Energy		sum of (265)…(271) =			11693.01	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			96.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32	(1a) x	2.7	(2a) =	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.37	x1/[1/(1.5)+ 0.04] =	9.01			(27)
Windows Type 2			7.76	x1/[1/(1.5)+ 0.04] =	10.98			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 5			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 6			10.76	x1/[1/(1.5)+ 0.04] =	15.23			(27)
Windows Type 7			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Walls	55.49	30.33	25.16	x 0.18 =	4.53			(29)
Total area of elements, m²			55.49					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			44.87	x 0 =	0			(32)
Party floor			121.32					(32a)
Party ceiling			121.32					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.45 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25503.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.33 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.36	61.07	60.79	59.49	59.24	58.1	58.1	57.89	58.54	59.24	59.74	60.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.68	112.4	112.12	110.82	110.57	109.43	109.43	109.22	109.87	110.57	111.07	111.58	

Average = Sum(39)$_{1...12}$ /12= 110.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.92	0.91	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	

Output from water heater (annual)$_{1...12}$	2199.71	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.57	84.73	90.16	82.45	81.97	74.94	73.58	78.52	77.69	85.42	88.28	93.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.58	22.72	18.48	13.99	10.46	8.83	9.54	12.4	16.64	21.13	24.66	26.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	286.92	289.9	282.4	266.42	246.26	227.31	214.65	211.67	219.18	235.15	255.31	274.26	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	128.46	126.09	121.19	114.51	110.18	104.08	98.9	105.54	107.9	114.81	122.6	126.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	509.98	507.74	491.08	463.95	435.92	409.24	392.11	398.64	412.74	440.11	471.6	495.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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TER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)
North	0.9x	0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
Northeast	0.9x	0.77	x	7.76	x	11.28	x	0.63	x	0.7	=	26.76	(75)
Northeast	0.9x	0.77	x	7.76	x	22.97	x	0.63	x	0.7	=	54.47	(75)
Northeast	0.9x	0.77	x	7.76	x	41.38	x	0.63	x	0.7	=	98.13	(75)
Northeast	0.9x	0.77	x	7.76	x	67.96	x	0.63	x	0.7	=	161.16	(75)
Northeast	0.9x	0.77	x	7.76	x	91.35	x	0.63	x	0.7	=	216.63	(75)
Northeast	0.9x	0.77	x	7.76	x	97.38	x	0.63	x	0.7	=	230.95	(75)
Northeast	0.9x	0.77	x	7.76	x	91.1	x	0.63	x	0.7	=	216.05	(75)
Northeast	0.9x	0.77	x	7.76	x	72.63	x	0.63	x	0.7	=	172.24	(75)
Northeast	0.9x	0.77	x	7.76	x	50.42	x	0.63	x	0.7	=	119.58	(75)
Northeast	0.9x	0.77	x	7.76	x	28.07	x	0.63	x	0.7	=	66.56	(75)
Northeast	0.9x	0.77	x	7.76	x	14.2	x	0.63	x	0.7	=	33.67	(75)
Northeast	0.9x	0.77	x	7.76	x	9.21	x	0.63	x	0.7	=	21.85	(75)
East	0.9x	0.77	x	10.76	x	19.64	x	0.63	x	0.7	=	64.58	(76)
East	0.9x	0.77	x	10.76	x	38.42	x	0.63	x	0.7	=	126.34	(76)
East	0.9x	0.77	x	10.76	x	63.27	x	0.63	x	0.7	=	208.07	(76)

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TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	10.76	x	92.28	x	0.63	x	0.7	=	303.45	(76)
East	0.9x	0.77	x	10.76	x	113.09	x	0.63	x	0.7	=	371.89	(76)
East	0.9x	0.77	x	10.76	x	115.77	x	0.63	x	0.7	=	380.7	(76)
East	0.9x	0.77	x	10.76	x	110.22	x	0.63	x	0.7	=	362.44	(76)
East	0.9x	0.77	x	10.76	x	94.68	x	0.63	x	0.7	=	311.33	(76)
East	0.9x	0.77	x	10.76	x	73.59	x	0.63	x	0.7	=	241.99	(76)
East	0.9x	0.77	x	10.76	x	45.59	x	0.63	x	0.7	=	149.92	(76)
East	0.9x	0.77	x	10.76	x	24.49	x	0.63	x	0.7	=	80.53	(76)
East	0.9x	0.77	x	10.76	x	16.15	x	0.63	x	0.7	=	53.11	(76)
Southeast	0.9x	0.77	x	6.37	x	36.79	x	0.63	x	0.7	=	71.63	(77)
Southeast	0.9x	0.77	x	6.37	x	62.67	x	0.63	x	0.7	=	122.01	(77)
Southeast	0.9x	0.77	x	6.37	x	85.75	x	0.63	x	0.7	=	166.94	(77)
Southeast	0.9x	0.77	x	6.37	x	106.25	x	0.63	x	0.7	=	206.85	(77)
Southeast	0.9x	0.77	x	6.37	x	119.01	x	0.63	x	0.7	=	231.68	(77)
Southeast	0.9x	0.77	x	6.37	x	118.15	x	0.63	x	0.7	=	230.01	(77)
Southeast	0.9x	0.77	x	6.37	x	113.91	x	0.63	x	0.7	=	221.75	(77)
Southeast	0.9x	0.77	x	6.37	x	104.39	x	0.63	x	0.7	=	203.22	(77)
Southeast	0.9x	0.77	x	6.37	x	92.85	x	0.63	x	0.7	=	180.76	(77)
Southeast	0.9x	0.77	x	6.37	x	69.27	x	0.63	x	0.7	=	134.85	(77)
Southeast	0.9x	0.77	x	6.37	x	44.07	x	0.63	x	0.7	=	85.79	(77)
Southeast	0.9x	0.77	x	6.37	x	31.49	x	0.63	x	0.7	=	61.3	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)

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TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	210.78	383.53	583.11	809.37	977.93	1000.14	952.21	823.38	661.72	440.26	257.09	177.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	720.77	891.27	1074.19	1273.32	1413.85	1409.38	1344.32	1222.01	1074.46	880.37	728.7	672.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.7	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.25	20.53	20.82	20.96	21	21	21	20.98	20.74	20.34	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.61	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.16	19.56	19.96	20.13	20.16	20.17	20.17	20.15	19.87	19.29	18.84	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	718.4	881.41	1031.31	1093.72	944.32	652.34	436.71	457.36	690.72	817.73	722.26	671.48	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1711.46	1666.06	1519.97	1274.59	979.16	655.56	437.01	458.05	711.1	1074.5	1413.77	1701.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3241.14 (98)

Space heating requirement in kWh/m²/year 26.72 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	790.2	563.94	388.84	139.28	27.72	0	0	0	0	204.32	532.5	819.67	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3466.46 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	
Efficiency of water heater													79.8 (216)
(217)m=	87.83	87.38	86.38	83.97	81.03	79.8	79.8	79.8	79.8	84.88	87.18	87.95	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	247.08	218.84	232.39	214.14	217.34	197.02	189.05	207.67	207.38	219.68	226.34	240.76	

Total = Sum(219a)$_{1...12}$ = 2617.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3466.46
Water heating fuel used		2617.68
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		451.74 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6610.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	748.76	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.42	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1314.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	234.45	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.55	(272)

TER = 19.04 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 39 Flat 39 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	432.38	**(P1)**
Transmission heat loss coefficient:	50.7	
Summer heat loss coefficient:	483.05	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
East (E)	0	1
North (N)	0	1

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Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
East (E)	0.9 x	16.35	108.47	0.4	0.8	0.9	459.68	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1211.46	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	556.2	533.9	543.25	
Total summer gains	1868.53	1745.36	1573.92	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	3.87	3.61	3.26	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.87	21.31	20.86	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:29

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 236.67m²

Site Reference : P1785 St Michaels

Plot Reference: Level 39 Flat 39 03

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	14.49 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	33.34m²
Windows facing: South West	30.67m²
Windows facing: South	22.53m²
Windows facing: South	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 39 Flat 39 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	236.67 m²	2.7 m

Living area:	98.45 m² (fraction 0.416)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	33.34	1
SW	16mm or more	0.8	0.4	1	30.67	1
S	16mm or more	1	0.4	1	22.53	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South West	0	0
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	114.87	91.39	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	391.77						N/A
Party Elements							
PARTY WALLS	35.74						N/A
WALLS TO CORRIDOR	28.53						N/A
PARTY CEILING	236.67						N/A

SAP Input

PARTY FLOOR	236.67	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0843

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.02	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.58	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 205.31 (fraction 0.867)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			30.67	x 1/[1/(1)+ 0.04]		=	29.49			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	114.87	91.39	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			114.87							(31)
Party wall			35.74	x	0	=	0			(32)
Party wall			28.53	x	0	=	0			(32)
Party floor			236.67							(32a)
Party ceiling			236.67							(32b)
Internal wall **			391.77							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 47740.65 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.69 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.2 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	76.87	75.85	74.83	69.72	68.7	63.59	63.59	62.57	65.63	68.7	70.74	72.78	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	180.07	179.05	178.02	172.92	171.9	166.79	166.79	165.77	168.83	171.9	173.94	175.98	

Average = Sum(39)$_{1...12}$ /12= 172.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.76	0.76	0.75	0.73	0.73	0.7	0.7	0.7	0.71	0.73	0.73	0.74	

Average = Sum(40)$_{1...12}$ /12= 0.73 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	

Output from water heater (annual)$_{1...12}$ — 2030.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.79	72.22	76.15	68.69	67.62	60.86	58.87	64.02	63.73	71.21	74.76	79.97	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	90.2	80.11	65.15	49.32	36.87	31.13	33.63	43.72	58.68	74.51	86.96	92.7	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	604.01	610.28	594.48	560.86	518.41	478.52	451.87	445.6	461.4	495.02	537.47	577.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	109.93	107.47	102.36	95.4	90.89	84.53	79.13	86.05	88.51	95.71	103.84	107.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	921.48	915.2	879.33	822.92	763.51	711.52	681.97	692.71	725.93	782.58	845.6	894.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	22.53	x	46.75	x	0.4	x	1	=	291.98	(78)
South	0.9x	0.77	x	4.85	x	46.75	x	0.4	x	0.7	=	44	(78)
South	0.9x	0.77	x	22.53	x	76.57	x	0.4	x	1	=	478.19	(78)
South	0.9x	0.77	x	4.85	x	76.57	x	0.4	x	0.7	=	72.06	(78)
South	0.9x	0.77	x	22.53	x	97.53	x	0.4	x	1	=	609.13	(78)
South	0.9x	0.77	x	4.85	x	97.53	x	0.4	x	0.7	=	91.79	(78)
South	0.9x	0.77	x	22.53	x	110.23	x	0.4	x	1	=	688.45	(78)
South	0.9x	0.77	x	4.85	x	110.23	x	0.4	x	0.7	=	103.74	(78)
South	0.9x	0.77	x	22.53	x	114.87	x	0.4	x	1	=	717.41	(78)
South	0.9x	0.77	x	4.85	x	114.87	x	0.4	x	0.7	=	108.1	(78)
South	0.9x	0.77	x	22.53	x	110.55	x	0.4	x	1	=	690.41	(78)
South	0.9x	0.77	x	4.85	x	110.55	x	0.4	x	0.7	=	104.04	(78)
South	0.9x	0.77	x	22.53	x	108.01	x	0.4	x	1	=	674.57	(78)
South	0.9x	0.77	x	4.85	x	108.01	x	0.4	x	0.7	=	101.65	(78)
South	0.9x	0.77	x	22.53	x	104.89	x	0.4	x	1	=	655.1	(78)
South	0.9x	0.77	x	4.85	x	104.89	x	0.4	x	0.7	=	98.72	(78)
South	0.9x	0.77	x	22.53	x	101.89	x	0.4	x	1	=	636.31	(78)
South	0.9x	0.77	x	4.85	x	101.89	x	0.4	x	0.7	=	95.88	(78)
South	0.9x	0.77	x	22.53	x	82.59	x	0.4	x	1	=	515.77	(78)
South	0.9x	0.77	x	4.85	x	82.59	x	0.4	x	0.7	=	77.72	(78)
South	0.9x	0.77	x	22.53	x	55.42	x	0.4	x	1	=	346.1	(78)
South	0.9x	0.77	x	4.85	x	55.42	x	0.4	x	0.7	=	52.15	(78)
South	0.9x	0.77	x	22.53	x	40.4	x	0.4	x	1	=	252.3	(78)
South	0.9x	0.77	x	4.85	x	40.4	x	0.4	x	0.7	=	38.02	(78)
Southwest	0.9x	0.77	x	33.34	x	36.79		0.4	x	0.8	=	272.03	(79)
Southwest	0.9x	0.77	x	30.67	x	36.79		0.4	x	0.8	=	250.25	(79)
Southwest	0.9x	0.77	x	33.34	x	62.67		0.4	x	0.8	=	463.38	(79)
Southwest	0.9x	0.77	x	30.67	x	62.67		0.4	x	0.8	=	426.27	(79)
Southwest	0.9x	0.77	x	33.34	x	85.75		0.4	x	0.8	=	634.01	(79)
Southwest	0.9x	0.77	x	30.67	x	85.75		0.4	x	0.8	=	583.24	(79)
Southwest	0.9x	0.77	x	33.34	x	106.25		0.4	x	0.8	=	785.57	(79)
Southwest	0.9x	0.77	x	30.67	x	106.25		0.4	x	0.8	=	722.66	(79)
Southwest	0.9x	0.77	x	33.34	x	119.01		0.4	x	0.8	=	879.9	(79)
Southwest	0.9x	0.77	x	30.67	x	119.01		0.4	x	0.8	=	809.44	(79)
Southwest	0.9x	0.77	x	33.34	x	118.15		0.4	x	0.8	=	873.54	(79)
Southwest	0.9x	0.77	x	30.67	x	118.15		0.4	x	0.8	=	803.58	(79)
Southwest	0.9x	0.77	x	33.34	x	113.91		0.4	x	0.8	=	842.19	(79)
Southwest	0.9x	0.77	x	30.67	x	113.91		0.4	x	0.8	=	774.74	(79)
Southwest	0.9x	0.77	x	33.34	x	104.39		0.4	x	0.8	=	771.81	(79)
Southwest	0.9x	0.77	x	30.67	x	104.39		0.4	x	0.8	=	710	(79)
Southwest	0.9x	0.77	x	33.34	x	92.85		0.4	x	0.8	=	686.5	(79)

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Southwest 0.9x	0.77	x	30.67	x	92.85	0.4	x	0.8	=	631.52	(79)
Southwest 0.9x	0.77	x	33.34	x	69.27	0.4	x	0.8	=	512.13	(79)
Southwest 0.9x	0.77	x	30.67	x	69.27	0.4	x	0.8	=	471.11	(79)
Southwest 0.9x	0.77	x	33.34	x	44.07	0.4	x	0.8	=	325.83	(79)
Southwest 0.9x	0.77	x	30.67	x	44.07	0.4	x	0.8	=	299.74	(79)
Southwest 0.9x	0.77	x	33.34	x	31.49	0.4	x	0.8	=	232.8	(79)
Southwest 0.9x	0.77	x	30.67	x	31.49	0.4	x	0.8	=	214.16	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	858.26	1439.89	1918.16	2300.42	2514.85	2471.56	2393.14	2235.62	2050.21	1576.74	1023.83	737.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	1779.74	2355.09	2797.49	3123.34	3278.36	3183.08	3075.12	2928.33	2776.14	2359.31	1869.43	1632.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.85	0.74	0.61	0.47	0.33	0.24	0.26	0.41	0.66	0.87	0.94	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.81	20.22	20.56	20.82	20.94	20.99	21	21	20.97	20.8	20.3	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.29	20.29	20.29	20.31	20.32	20.34	20.34	20.34	20.33	20.32	20.31	20.3	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.92	0.83	0.72	0.58	0.44	0.3	0.2	0.22	0.37	0.63	0.85	0.93	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.69	19.27	19.74	20.1	20.25	20.33	20.33	20.34	20.3	20.08	19.4	18.61	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.9	0.82	0.72	0.58	0.45	0.31	0.22	0.24	0.39	0.63	0.84	0.92	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	1603.99	1925.85	2003.79	1820.6	1464.6	990.53	666.8	695.28	1070.65	1496.7	1566.57	1498.19	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	2675.7	2643.94	2417.77	1988.88	1519.44	1000.9	668.87	698.15	1094.29	1681.42	2204.1	2619.78	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3180.79	(98)
Space heating requirement in kWh/m²/year	13.44	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1567.81	1234.23	1259.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1523.49	1215.53	1236.37	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3600.36	3479.15	3305.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1495.34	1684.14	1539.64	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	4719.12	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.87	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	324.3	365.25	333.91	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	1023.45	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.32	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	469.03	283.86	181.18	71.27	24	0	0	0	0	80.84	270.01	490.86	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1871.06	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Total = Sum(219a)$_{1...12}$ = 2030.26 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	54.6	61.49	56.21	0	0	0	0

Total = Sum(221)$_{6...8}$ = 172.3 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1871.06	
Water heating fuel used		2030.26	
Space cooling fuel used		172.3	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	721.12		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	721.12	(231)
Electricity for lighting		637.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5431.89	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	246.79	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	267.79	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	22.73	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	95.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	84.04	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				716.47	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.07	(257)
SAP rating (Section 12)		85.1	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	971.08	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1053.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2024.78	(265)
Space cooling	(221)	x	0.519	=	89.42	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	374.26	(267)
Electricity for lighting	(232)	x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =				2819.15	(272)
CO2 emissions per m²	(272) ÷ (4) =				11.91	(273)
EI rating (section 14)					87	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	5744.14	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6232.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				11977.05	(265)
Space cooling	(221)	x	3.07	=	528.96	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	2213.84	(267)
Electricity for lighting	(232)	x	0	=	1956.05	(268)
'Total Primary Energy	sum of (265)…(271) =				16675.9	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				70.46	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.06 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.31 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.24 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.31	0.3	0.3	0.27	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.58	x1/[1/(1.5)+ 0.04] =	30.54			(27)
Windows Type 2			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 3			14.59	x1/[1/(1.5)+ 0.04] =	20.65			(27)
Windows Type 4			3.14	x1/[1/(1.5)+ 0.04] =	4.44			(27)
Walls	114.87	59.17	55.7	x 0.18 =	10.03			(29)
Total area of elements, m²			114.87					(31)
Party wall			35.74	x 0 =	0			(32)
Party wall			28.53	x 0 =	0			(32)
Party floor			236.67					(32a)
Party ceiling			236.67					(32b)
Internal wall **			391.77					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 48191.73 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.47 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.22 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	115.5	115.11	114.72	112.92	112.59	111.02	111.02	110.73	111.62	112.59	113.27	113.98	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	218.72	218.33	217.95	216.15	215.81	214.24	214.24	213.95	214.85	215.81	216.49	217.2	

Average = Sum(39)$_{1...12}$ /12= 216.15 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.9	0.91	0.91	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	

Output from water heater (annual)$_{1...12}$ — 2267.46 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.91	86.78	92.27	84.29	83.74	76.46	74.99	80.14	79.32	87.32	90.36	96.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	36.08	32.04	26.06	19.73	14.75	12.45	13.45	17.49	23.47	29.8	34.78	37.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	404.69	408.89	398.3	375.78	347.34	320.61	302.75	298.55	309.14	331.66	360.1	386.83	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	131.6	129.13	124.02	117.07	112.55	106.19	100.79	107.71	110.17	117.37	125.5	129.14	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	644.11	641.81	620.13	584.31	546.38	511	488.74	495.5	514.53	550.58	592.13	624.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	14.59	x	46.75	x	0.63	x	0.7	=	208.46	(78)
South	0.9x	0.77	x	3.14	x	46.75	x	0.63	x	0.7	=	44.86	(78)
South	0.9x	0.77	x	14.59	x	76.57	x	0.63	x	0.7	=	341.41	(78)
South	0.9x	0.77	x	3.14	x	76.57	x	0.63	x	0.7	=	73.48	(78)
South	0.9x	0.77	x	14.59	x	97.53	x	0.63	x	0.7	=	434.89	(78)
South	0.9x	0.77	x	3.14	x	97.53	x	0.63	x	0.7	=	93.6	(78)
South	0.9x	0.77	x	14.59	x	110.23	x	0.63	x	0.7	=	491.52	(78)
South	0.9x	0.77	x	3.14	x	110.23	x	0.63	x	0.7	=	105.78	(78)
South	0.9x	0.77	x	14.59	x	114.87	x	0.63	x	0.7	=	512.2	(78)
South	0.9x	0.77	x	3.14	x	114.87	x	0.63	x	0.7	=	110.23	(78)
South	0.9x	0.77	x	14.59	x	110.55	x	0.63	x	0.7	=	492.92	(78)
South	0.9x	0.77	x	3.14	x	110.55	x	0.63	x	0.7	=	106.08	(78)
South	0.9x	0.77	x	14.59	x	108.01	x	0.63	x	0.7	=	481.61	(78)
South	0.9x	0.77	x	3.14	x	108.01	x	0.63	x	0.7	=	103.65	(78)
South	0.9x	0.77	x	14.59	x	104.89	x	0.63	x	0.7	=	467.71	(78)
South	0.9x	0.77	x	3.14	x	104.89	x	0.63	x	0.7	=	100.66	(78)
South	0.9x	0.77	x	14.59	x	101.89	x	0.63	x	0.7	=	454.3	(78)
South	0.9x	0.77	x	3.14	x	101.89	x	0.63	x	0.7	=	97.77	(78)
South	0.9x	0.77	x	14.59	x	82.59	x	0.63	x	0.7	=	368.24	(78)
South	0.9x	0.77	x	3.14	x	82.59	x	0.63	x	0.7	=	79.25	(78)
South	0.9x	0.77	x	14.59	x	55.42	x	0.63	x	0.7	=	247.1	(78)
South	0.9x	0.77	x	3.14	x	55.42	x	0.63	x	0.7	=	53.18	(78)
South	0.9x	0.77	x	14.59	x	40.4	x	0.63	x	0.7	=	180.13	(78)
South	0.9x	0.77	x	3.14	x	40.4	x	0.63	x	0.7	=	38.77	(78)
Southwest	0.9x	0.77	x	21.58	x	36.79		0.63	x	0.7	=	242.66	(79)
Southwest	0.9x	0.77	x	19.86	x	36.79		0.63	x	0.7	=	223.32	(79)
Southwest	0.9x	0.77	x	21.58	x	62.67		0.63	x	0.7	=	413.34	(79)
Southwest	0.9x	0.77	x	19.86	x	62.67		0.63	x	0.7	=	380.4	(79)
Southwest	0.9x	0.77	x	21.58	x	85.75		0.63	x	0.7	=	565.55	(79)
Southwest	0.9x	0.77	x	19.86	x	85.75		0.63	x	0.7	=	520.47	(79)
Southwest	0.9x	0.77	x	21.58	x	106.25		0.63	x	0.7	=	700.74	(79)
Southwest	0.9x	0.77	x	19.86	x	106.25		0.63	x	0.7	=	644.89	(79)
Southwest	0.9x	0.77	x	21.58	x	119.01		0.63	x	0.7	=	784.89	(79)
Southwest	0.9x	0.77	x	19.86	x	119.01		0.63	x	0.7	=	722.33	(79)
Southwest	0.9x	0.77	x	21.58	x	118.15		0.63	x	0.7	=	779.21	(79)
Southwest	0.9x	0.77	x	19.86	x	118.15		0.63	x	0.7	=	717.11	(79)
Southwest	0.9x	0.77	x	21.58	x	113.91		0.63	x	0.7	=	751.25	(79)
Southwest	0.9x	0.77	x	19.86	x	113.91		0.63	x	0.7	=	691.37	(79)
Southwest	0.9x	0.77	x	21.58	x	104.39		0.63	x	0.7	=	688.47	(79)
Southwest	0.9x	0.77	x	19.86	x	104.39		0.63	x	0.7	=	633.6	(79)
Southwest	0.9x	0.77	x	21.58	x	92.85		0.63	x	0.7	=	612.37	(79)

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Southwest	0.9x	0.77	x	19.86	x	92.85		0.63	x	0.7	=	563.56	(79)
Southwest	0.9x	0.77	x	21.58	x	69.27		0.63	x	0.7	=	456.83	(79)
Southwest	0.9x	0.77	x	19.86	x	69.27		0.63	x	0.7	=	420.42	(79)
Southwest	0.9x	0.77	x	21.58	x	44.07		0.63	x	0.7	=	290.65	(79)
Southwest	0.9x	0.77	x	19.86	x	44.07		0.63	x	0.7	=	267.48	(79)
Southwest	0.9x	0.77	x	21.58	x	31.49		0.63	x	0.7	=	207.67	(79)
Southwest	0.9x	0.77	x	19.86	x	31.49		0.63	x	0.7	=	191.11	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	719.31	1208.62	1614.51	1942.94	2129.65	2095.33	2027.88	1890.44	1728	1324.74	858.41	617.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1363.41	1850.43	2234.64	2527.26	2676.03	2606.33	2516.62	2385.94	2242.53	1875.32	1450.54	1242.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.71	0.52	0.37	0.41	0.64	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.3	20.58	20.83	20.96	20.99	21	21	20.98	20.79	20.35	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.95	0.84	0.66	0.46	0.3	0.34	0.57	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.24	19.63	19.97	20.12	20.16	20.16	20.16	20.15	19.93	19.31	18.8	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.98	0.95	0.85	0.68	0.48	0.33	0.37	0.6	0.9	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1359.42	1822.08	2115.87	2144.49	1818.6	1257.64	837.2	878.35	1346.37	1689.15	1435.85	1240.29	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3294.33	3227	2947.92	2470.15	1892.44	1265.55	837.87	879.59	1374.04	2089.87	2737.27	3280.14	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6044.94	(98)
Space heating requirement in kWh/m²/year	25.54	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	1539.65	1009.74	662.08	250.78	58.76	0	0	0	0	318.86	1002.16	1623.15	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 6465.18 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	88.89	88.45	87.56	85.44	82.06	79.8	79.8	79.8	79.8	85.98	88.38	89

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	252.02	223.15	236.5	216.92	221.09	202.75	194.36	213.77	213.55	223.54	230.35	245.56

Total = Sum(219a)$_{1...12}$ = 2673.55 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		6465.18
Water heating fuel used		2673.55
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		637.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9850.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	1396.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	577.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1973.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			2343.57	(272)

TER = 14.49 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 39 Flat 39 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	843.49	**(P1)**
Transmission heat loss coefficient:	103.2	
Summer heat loss coefficient:	946.69	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SE)	0	1
South West (SW)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SE)	1	0.9	1	0.9	**(P8)**
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SE)	0.9 x	33.34	112.1	0.4	0.8	0.9	968.75	
South West (SW)	0.9 x	30.67	112.1	0.4	0.8	0.9	891.17	
South (S)	0.9 x	22.53	106.3	0.4	1	0.9	775.94	
South (S GLAZED DOOR)	0.9 x	4.85	106.3	0.4	0.7	0.9	116.93	
						Total	2752.78	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	711.52	681.97	692.71	
Total summer gains	3643.69	3434.75	3222.56	**(P5)**
Summer gain/loss ratio	3.85	3.63	3.4	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.85	21.33	21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:24

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 122.24m²

Site Reference : P1785 St Michaels **Plot Reference:** Level 39 Flat 39 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.89 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.15 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	37.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.8 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.90 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: West	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 39 Flat 39 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	122.24 m²	2.7 m

Living area:	63.24 m² (fraction 0.517)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
W	16mm or more	1	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	52.72	46.1	6.62	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	45.2						N/A
PARTY CEILING	122.24						N/A
PARTY FLOOR	122.24						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0748

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	30.48	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.35	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	61.15	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 106.48 (fraction 0.871)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24 (1a)	x	2.7 (2a)	=	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x 1/[1/(1)+ 0.04]		=	9.31			(27)
Windows Type 2			11.79	x 1/[1/(1)+ 0.04]		=	11.34			(27)
Windows Type 3			1.59	x 1/[1/(1)+ 0.04]		=	1.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 5			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 6			16.35	x 1/[1/(1)+ 0.04]		=	15.72			(27)
Windows Type 7			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Walls	52.72	46.1	6.62	x	0.24	=	1.59			(29)
Total area of elements, m²			52.72							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			45.2	x	0	=	0			(32)
Party floor			122.24							(32a)
Party ceiling			122.24							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25416.49 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 3.94 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 49.86 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.7	39.18	38.65	36.01	35.48	32.84	32.84	32.32	33.9	35.48	36.54	37.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.56	89.03	88.51	85.87	85.34	82.7	82.7	82.18	83.76	85.34	86.4	87.45	

Average = Sum(39)$_{1...12}$ /12= | 85.74 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.69	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= | 0.7 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.87 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 102.4 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = | 1228.8 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = | 1611.15 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 190 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 1.61 | (48)

Temperature factor from Table 2b | 0.6 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.97 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Output from water heater (annual)$_{1...12}$ — 1963.74 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.5	70.22	74.08	66.89	65.89	59.37	57.49	62.43	62.12	69.33	72.72	77.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	64.21	57.03	46.38	35.11	26.25	22.16	23.94	31.12	41.77	53.04	61.91	66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	430	434.46	423.22	399.28	369.06	340.67	321.69	317.23	328.47	352.41	382.63	411.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	106.85	104.49	99.57	92.9	88.56	82.46	77.27	83.92	86.28	93.19	100.99	104.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	713.6	708.52	681.71	639.83	596.41	557.81	535.44	544.8	569.06	611.18	658.06	694.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
Southeast 0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast 0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast 0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)

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Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	16.35	x	19.64	x	0.4	x	1	=	89.01	(80)
West	0.9x	0.77	x	16.35	x	38.42	x	0.4	x	1	=	174.13	(80)
West	0.9x	0.77	x	16.35	x	63.27	x	0.4	x	1	=	286.77	(80)
West	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	1	=	418.23	(80)
West	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	1	=	512.56	(80)
West	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	1	=	524.7	(80)
West	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	1	=	499.53	(80)
West	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	1	=	429.09	(80)

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West	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	1	=	333.52	(80)
West	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	1	=	206.62	(80)
West	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	1	=	110.99	(80)
West	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	1	=	73.2	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	251.24	459.43	702.65	979.02	1184.18	1211.12	1153.1	996.62	798.88	528.66	306.89	211.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.83	1167.95	1384.36	1618.85	1780.59	1768.93	1688.54	1541.42	1367.94	1139.84	964.95	905.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.85	0.75	0.59	0.43	0.3	0.21	0.24	0.41	0.68	0.86	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.25	20.58	20.85	20.96	20.99	21	21	20.98	20.8	20.36	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.33	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.84	0.73	0.56	0.4	0.27	0.18	0.21	0.38	0.65	0.84	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.33	19.79	20.16	20.3	20.35	20.36	20.36	20.33	20.11	19.5	18.86	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.83	0.73	0.57	0.42	0.28	0.2	0.23	0.39	0.65	0.83	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	858.27	965.6	1005.23	924.06	742.83	499.95	337.63	351.58	538.38	745.71	805.49	817.39	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1356.33	1327.07	1212.24	997.74	762.95	503.24	338.29	352.65	549.79	842.04	1109.9	1329.71	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1507.51 (98)

Space heating requirement in kWh/m²/year 12.33 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	777.41	612	624.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	762.73	605.78	615.42	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1973.41	1883.21	1709.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	871.69	950.41	814.13	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 2636.23 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	189.83	206.97	177.29	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ = 574.09 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.7 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	217.97	142.88	90.6	31.21	8.81	0	0	0	0	42.16	128.93	224.22	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 886.77 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72

Efficiency of water heater 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Total = Sum(219a)$_{1...12}$ = 1963.74 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	31.96	34.84	29.85	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 96.65 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		886.77	
Water heating fuel used		1963.74	
Space cooling fuel used		96.65	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	372.46		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		372.46	(231)
Electricity for lighting		453.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3773.21	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	116.96	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	259.02	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	12.75	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	49.13	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.83	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost (245)...(247) + (250)…(254) =					497.69	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.25	(257)
SAP rating (Section 12)		82.56	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	460.23	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1019.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1479.41	(265)
Space cooling	(221) x		0.519	=	50.16	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	193.31	(267)
Electricity for lighting	(232) x		0.519	=	235.42	(268)
Total CO2, kg/year		sum of (265)…(271) =			1958.3	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.02	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2722.38	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6028.67	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8751.06	(265)
Space cooling	(221) x		3.07	=	296.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	1143.45	(267)
Electricity for lighting	(232) x		0	=	1392.54	(268)
'Total Primary Energy		sum of (265)…(271) =			11583.75	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			94.76	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 39 Flat 39 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24	(1a) x	2.7	(2a) =	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.42	x1/[1/(1.5)+ 0.04] =	9.08			(27)
Windows Type 2			7.82	x1/[1/(1.5)+ 0.04] =	11.07			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 5			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 6			10.84	x1/[1/(1.5)+ 0.04] =	15.34			(27)
Windows Type 7			1.04	x1/[1/(1.5)+ 0.04] =	1.47			(27)
Walls	52.72	30.57	22.15	x 0.18 =	3.99			(29)
Total area of elements, m²			52.72					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			45.2	x 0 =	0			(32)
Party floor			122.24					(32a)
Party ceiling			122.24					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25633.91 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.78	61.5	61.22	59.91	59.67	58.53	58.53	58.31	58.96	59.67	60.16	60.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.77	112.48	112.2	110.89	110.65	109.51	109.51	109.3	109.95	110.65	111.14	111.66	

Average = Sum(39)$_{1...12}$ /12= 110.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.91	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.4 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = 1228.8 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = 1611.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Output from water heater (annual)$_{1...12}$ 2200.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.61	84.77	90.2	82.48	82.01	74.97	73.6	78.55	77.72	85.45	88.31	93.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.68	22.81	18.55	14.05	10.5	8.86	9.58	12.45	16.71	21.22	24.76	26.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	288.1	291.09	283.56	267.52	247.27	228.25	215.53	212.54	220.08	236.12	256.36	275.39	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	128.51	126.15	121.24	114.56	110.22	104.12	98.93	105.58	107.94	114.85	122.66	126.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	511.37	509.13	492.42	465.2	437.07	410.3	393.12	399.65	413.8	441.26	472.86	497.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North 0.9x	0.77	x	1.04	x	10.63	x	0.63	x	0.7	=	3.38	(74)
North 0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North 0.9x	0.77	x	1.04	x	20.32	x	0.63	x	0.7	=	6.46	(74)
North 0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North 0.9x	0.77	x	1.04	x	34.53	x	0.63	x	0.7	=	10.98	(74)
North 0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North 0.9x	0.77	x	1.04	x	55.46	x	0.63	x	0.7	=	17.63	(74)
North 0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North 0.9x	0.77	x	1.04	x	74.72	x	0.63	x	0.7	=	23.75	(74)
North 0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North 0.9x	0.77	x	1.04	x	79.99	x	0.63	x	0.7	=	25.42	(74)
North 0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North 0.9x	0.77	x	1.04	x	74.68	x	0.63	x	0.7	=	23.74	(74)
North 0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North 0.9x	0.77	x	1.04	x	59.25	x	0.63	x	0.7	=	18.83	(74)
North 0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North 0.9x	0.77	x	1.04	x	41.52	x	0.63	x	0.7	=	13.2	(74)
North 0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North 0.9x	0.77	x	1.04	x	24.19	x	0.63	x	0.7	=	7.69	(74)
North 0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North 0.9x	0.77	x	1.04	x	13.12	x	0.63	x	0.7	=	4.17	(74)
North 0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North 0.9x	0.77	x	1.04	x	8.86	x	0.63	x	0.7	=	2.82	(74)
Northeast 0.9x	0.77	x	7.82	x	11.28	x	0.63	x	0.7	=	26.97	(75)
Northeast 0.9x	0.77	x	7.82	x	22.97	x	0.63	x	0.7	=	54.89	(75)
Northeast 0.9x	0.77	x	7.82	x	41.38	x	0.63	x	0.7	=	98.89	(75)
Northeast 0.9x	0.77	x	7.82	x	67.96	x	0.63	x	0.7	=	162.41	(75)
Northeast 0.9x	0.77	x	7.82	x	91.35	x	0.63	x	0.7	=	218.31	(75)
Northeast 0.9x	0.77	x	7.82	x	97.38	x	0.63	x	0.7	=	232.74	(75)
Northeast 0.9x	0.77	x	7.82	x	91.1	x	0.63	x	0.7	=	217.72	(75)
Northeast 0.9x	0.77	x	7.82	x	72.63	x	0.63	x	0.7	=	173.57	(75)
Northeast 0.9x	0.77	x	7.82	x	50.42	x	0.63	x	0.7	=	120.5	(75)
Northeast 0.9x	0.77	x	7.82	x	28.07	x	0.63	x	0.7	=	67.08	(75)
Northeast 0.9x	0.77	x	7.82	x	14.2	x	0.63	x	0.7	=	33.93	(75)
Northeast 0.9x	0.77	x	7.82	x	9.21	x	0.63	x	0.7	=	22.02	(75)
Southeast 0.9x	0.77	x	6.42	x	36.79	x	0.63	x	0.7	=	72.19	(77)
Southeast 0.9x	0.77	x	6.42	x	62.67	x	0.63	x	0.7	=	122.97	(77)
Southeast 0.9x	0.77	x	6.42	x	85.75	x	0.63	x	0.7	=	168.25	(77)

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Southeast	0.9x	0.77	x	6.42	x	106.25	x	0.63	x	0.7	=	208.47	(77)
Southeast	0.9x	0.77	x	6.42	x	119.01	x	0.63	x	0.7	=	233.5	(77)
Southeast	0.9x	0.77	x	6.42	x	118.15	x	0.63	x	0.7	=	231.81	(77)
Southeast	0.9x	0.77	x	6.42	x	113.91	x	0.63	x	0.7	=	223.49	(77)
Southeast	0.9x	0.77	x	6.42	x	104.39	x	0.63	x	0.7	=	204.82	(77)
Southeast	0.9x	0.77	x	6.42	x	92.85	x	0.63	x	0.7	=	182.18	(77)
Southeast	0.9x	0.77	x	6.42	x	69.27	x	0.63	x	0.7	=	135.91	(77)
Southeast	0.9x	0.77	x	6.42	x	44.07	x	0.63	x	0.7	=	86.47	(77)
Southeast	0.9x	0.77	x	6.42	x	31.49	x	0.63	x	0.7	=	61.78	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.7	x	46.75	x	0.63	x	0.7	=	24.29	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.7	x	76.57	x	0.63	x	0.7	=	39.78	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.7	x	97.53	x	0.63	x	0.7	=	50.67	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.7	x	110.23	x	0.63	x	0.7	=	57.27	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.7	x	114.87	x	0.63	x	0.7	=	59.68	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.7	x	110.55	x	0.63	x	0.7	=	57.43	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.7	x	108.01	x	0.63	x	0.7	=	56.12	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.7	x	104.89	x	0.63	x	0.7	=	54.5	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.7	x	101.89	x	0.63	x	0.7	=	52.93	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.7	x	82.59	x	0.63	x	0.7	=	42.91	(78)
South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.7	x	55.42	x	0.63	x	0.7	=	28.79	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.7	x	40.4	x	0.63	x	0.7	=	20.99	(78)
West	0.9x	0.77	x	10.84	x	19.64	x	0.63	x	0.7	=	65.07	(80)
West	0.9x	0.77	x	10.84	x	38.42	x	0.63	x	0.7	=	127.28	(80)
West	0.9x	0.77	x	10.84	x	63.27	x	0.63	x	0.7	=	209.61	(80)
West	0.9x	0.77	x	10.84	x	92.28	x	0.63	x	0.7	=	305.71	(80)
West	0.9x	0.77	x	10.84	x	113.09	x	0.63	x	0.7	=	374.66	(80)
West	0.9x	0.77	x	10.84	x	115.77	x	0.63	x	0.7	=	383.53	(80)
West	0.9x	0.77	x	10.84	x	110.22	x	0.63	x	0.7	=	365.14	(80)
West	0.9x	0.77	x	10.84	x	94.68	x	0.63	x	0.7	=	313.65	(80)

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West	0.9x	0.77	x	10.84	x	73.59	x	0.63	x	0.7	=	243.79	(80)
West	0.9x	0.77	x	10.84	x	45.59	x	0.63	x	0.7	=	151.03	(80)
West	0.9x	0.77	x	10.84	x	24.49	x	0.63	x	0.7	=	81.13	(80)
West	0.9x	0.77	x	10.84	x	16.15	x	0.63	x	0.7	=	53.51	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	212.42	386.5	587.64	815.68	985.58	1007.97	959.66	829.8	666.86	443.68	259.08	178.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	723.79	895.63	1080.06	1280.87	1422.65	1418.27	1352.78	1229.45	1080.66	884.94	731.94	675.7	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.69	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.26	20.54	20.83	20.96	21	21	21	20.98	20.75	20.34	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.18	19.57	19.97	20.13	20.17	20.17	20.17	20.15	19.88	19.31	18.85	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	721.46	885.79	1036.82	1098.75	946.96	653.63	437.7	458.38	692.61	821.73	725.54	674.21	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1714.5	1668.99	1522.63	1276.68	980.68	656.7	437.98	459.03	712.35	1076.43	1416.28	1704.56	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3233.19 (98)

Space heating requirement in kWh/m²/year 26.45 (99)

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TER WorkSheet: New dwelling design stage

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
790.19	562.9	386.57	137.02	26.83	0	0	0	0	202.67	531.91	819.87	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3457.96 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Efficiency of water heater 79.8 (216)

(217)m=	87.83	87.38	86.36	83.93	80.99	79.8	79.8	79.8	79.8	84.86	87.18	87.95

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	247.23	218.98	232.56	214.36	217.56	197.12	189.14	207.78	207.49	219.86	226.48	240.9	

Total = Sum(219a)$_{1...12}$ = 2619.48 (219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1		3457.96
Water heating fuel used		2619.48
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		453.6 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6606.04 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	746.92	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.81	(264)

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TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1312.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	235.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.07	(272)

TER = 18.89 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 39 Flat 39 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	435.66	**(P1)**
Transmission heat loss coefficient:	49.9	
Summer heat loss coefficient:	485.52	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
West (W)	0	1
North (N)	0	1

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Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
West (W)	0.9 x	16.35	108.47	0.4	1	0.9	574.6	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1326.38	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	557.81	535.44	544.8	
Total summer gains	1994.64	1861.82	1672.58	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	4.11	3.83	3.44	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.11	21.53	21.04	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:18

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 218.74m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 40 Flat 40 01
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.54 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.60 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	41.2 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.85 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North West	33.34m²
Windows facing: North East	31.09m²
Windows facing: North	22.53m²
Windows facing: North	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 40 Flat 40 01

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	218.74 m²	2.7 m

Living area:	99.26 m² (fraction 0.454)
Front of dwelling faces:	South

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
NW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
NW	16mm or more	0.8	0.4	1	33.34	1
NE	16mm or more	0.8	0.4	1	31.09	1
N	16mm or more	1	0.4	1	22.53	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
NW		OPAQUE CURT WALL	North West	0	0
NE		OPAQUE CURT WALL	North East	0	0
N		OPAQUE CURT WALL	North	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	115.29	91.81	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	354.24						N/A
Party Elements							
PARTY WALLS	40.89						N/A
WALLS TO CORRIDOR	40.3						N/A
PARTY CEILING	218.74						N/A

SAP Input

PARTY FLOOR 218.74 N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0844

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.58	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.14	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 1
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 167.89 (fraction 0.768)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

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SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.23	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			31.09	x 1/[1/(1)+ 0.04]		=	29.89			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	115.29	91.81	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			115.29							(31)
Party wall			40.89	x	0	=	0			(32)
Party wall			40.3	x	0	=	0			(32)
Party floor			218.74							(32a)
Party ceiling			218.74							(32b)
Internal wall **			354.24							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 44513.88 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.64 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	80.36	79.24	78.11	72.48	71.35	65.72	65.72	64.59	67.97	71.35	73.6	75.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	184	182.88	181.75	176.12	174.99	169.36	169.36	168.23	171.61	174.99	177.24	179.5	

Average = Sum(39)$_{1...12}$ /12= 175.84 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.84	0.84	0.83	0.81	0.8	0.77	0.77	0.77	0.78	0.8	0.81	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52	

Output from water heater (annual)$_{1...12}$ — 2021.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.49	71.96	75.88	68.45	67.39	60.67	58.69	63.81	63.52	70.96	74.49	79.68	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	181.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	86.59	76.91	62.55	47.35	35.4	29.88	32.29	41.97	56.34	71.53	83.49	89	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	579.89	585.91	570.74	538.46	497.71	459.41	433.82	427.81	442.97	475.25	516	554.3	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	56.18	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	109.53	107.08	101.99	95.08	90.58	84.26	78.89	85.77	88.22	95.38	103.46	107.09	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	892.72	886.61	851.99	797.6	740.4	690.26	661.71	672.26	704.24	758.87	819.66	867.1	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	22.53	x	10.63	x	0.4	x	1	=	66.41	(74)
North	0.9x	0.77	x	4.85	x	10.63	x	0.4	x	0.7	=	10.01	(74)
North	0.9x	0.77	x	22.53	x	20.32	x	0.4	x	1	=	126.91	(74)
North	0.9x	0.77	x	4.85	x	20.32	x	0.4	x	0.7	=	19.12	(74)
North	0.9x	0.77	x	22.53	x	34.53	x	0.4	x	1	=	215.65	(74)
North	0.9x	0.77	x	4.85	x	34.53	x	0.4	x	0.7	=	32.5	(74)
North	0.9x	0.77	x	22.53	x	55.46	x	0.4	x	1	=	346.39	(74)
North	0.9x	0.77	x	4.85	x	55.46	x	0.4	x	0.7	=	52.2	(74)
North	0.9x	0.77	x	22.53	x	74.72	x	0.4	x	1	=	466.62	(74)
North	0.9x	0.77	x	4.85	x	74.72	x	0.4	x	0.7	=	70.31	(74)
North	0.9x	0.77	x	22.53	x	79.99	x	0.4	x	1	=	499.53	(74)
North	0.9x	0.77	x	4.85	x	79.99	x	0.4	x	0.7	=	75.27	(74)
North	0.9x	0.77	x	22.53	x	74.68	x	0.4	x	1	=	466.38	(74)
North	0.9x	0.77	x	4.85	x	74.68	x	0.4	x	0.7	=	70.28	(74)
North	0.9x	0.77	x	22.53	x	59.25	x	0.4	x	1	=	370.01	(74)
North	0.9x	0.77	x	4.85	x	59.25	x	0.4	x	0.7	=	55.76	(74)
North	0.9x	0.77	x	22.53	x	41.52	x	0.4	x	1	=	259.28	(74)
North	0.9x	0.77	x	4.85	x	41.52	x	0.4	x	0.7	=	39.07	(74)
North	0.9x	0.77	x	22.53	x	24.19	x	0.4	x	1	=	151.07	(74)
North	0.9x	0.77	x	4.85	x	24.19	x	0.4	x	0.7	=	22.76	(74)
North	0.9x	0.77	x	22.53	x	13.12	x	0.4	x	1	=	81.92	(74)
North	0.9x	0.77	x	4.85	x	13.12	x	0.4	x	0.7	=	12.34	(74)
North	0.9x	0.77	x	22.53	x	8.86	x	0.4	x	1	=	55.36	(74)
North	0.9x	0.77	x	4.85	x	8.86	x	0.4	x	0.7	=	8.34	(74)
Northeast	0.9x	0.77	x	31.09	x	11.28	x	0.4	x	0.8	=	77.79	(75)
Northeast	0.9x	0.77	x	31.09	x	22.97	x	0.4	x	0.8	=	158.34	(75)
Northeast	0.9x	0.77	x	31.09	x	41.38	x	0.4	x	0.8	=	285.29	(75)
Northeast	0.9x	0.77	x	31.09	x	67.96	x	0.4	x	0.8	=	468.52	(75)
Northeast	0.9x	0.77	x	31.09	x	91.35	x	0.4	x	0.8	=	629.79	(75)
Northeast	0.9x	0.77	x	31.09	x	97.38	x	0.4	x	0.8	=	671.42	(75)
Northeast	0.9x	0.77	x	31.09	x	91.1	x	0.4	x	0.8	=	628.1	(75)
Northeast	0.9x	0.77	x	31.09	x	72.63	x	0.4	x	0.8	=	500.73	(75)
Northeast	0.9x	0.77	x	31.09	x	50.42	x	0.4	x	0.8	=	347.63	(75)
Northeast	0.9x	0.77	x	31.09	x	28.07	x	0.4	x	0.8	=	193.51	(75)
Northeast	0.9x	0.77	x	31.09	x	14.2	x	0.4	x	0.8	=	97.88	(75)
Northeast	0.9x	0.77	x	31.09	x	9.21	x	0.4	x	0.8	=	63.53	(75)
Northwest	0.9x	0.77	x	33.34	x	11.28	x	0.4	x	0.8	=	83.42	(81)
Northwest	0.9x	0.77	x	33.34	x	22.97	x	0.4	x	0.8	=	169.8	(81)
Northwest	0.9x	0.77	x	33.34	x	41.38	x	0.4	x	0.8	=	305.93	(81)
Northwest	0.9x	0.77	x	33.34	x	67.96	x	0.4	x	0.8	=	502.43	(81)
Northwest	0.9x	0.77	x	33.34	x	91.35	x	0.4	x	0.8	=	675.36	(81)

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Northwest	0.9x	0.77	x	33.34	x	97.38	x	0.4	x	0.8	=	720.01	(81)
Northwest	0.9x	0.77	x	33.34	x	91.1	x	0.4	x	0.8	=	673.55	(81)
Northwest	0.9x	0.77	x	33.34	x	72.63	x	0.4	x	0.8	=	536.97	(81)
Northwest	0.9x	0.77	x	33.34	x	50.42	x	0.4	x	0.8	=	372.78	(81)
Northwest	0.9x	0.77	x	33.34	x	28.07	x	0.4	x	0.8	=	207.51	(81)
Northwest	0.9x	0.77	x	33.34	x	14.2	x	0.4	x	0.8	=	104.96	(81)
Northwest	0.9x	0.77	x	33.34	x	9.21	x	0.4	x	0.8	=	68.13	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	237.63	474.18	839.37	1369.54	1842.09	1966.24	1838.31	1463.46	1018.77	574.86	297.11	195.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1130.35	1360.79	1691.36	2167.14	2582.49	2656.5	2500.02	2135.72	1723	1333.73	1116.78	1062.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.9	0.76	0.57	0.4	0.29	0.35	0.61	0.87	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.2	19.49	19.98	20.55	20.86	20.97	20.99	20.99	20.88	20.39	19.71	19.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.22	20.22	20.23	20.25	20.25	20.28	20.28	20.28	20.27	20.25	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.95	0.89	0.74	0.54	0.35	0.25	0.3	0.56	0.85	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.76	18.19	18.89	19.7	20.1	20.25	20.27	20.27	20.14	19.5	18.53	17.75	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.41	18.78	19.38	20.09	20.44	20.58	20.6	20.59	20.48	19.9	19.06	18.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.87	0.73	0.54	0.37	0.27	0.33	0.58	0.84	0.94	0.97	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1084.44	1269.12	1471.42	1581.21	1407.26	988.03	671.12	694.65	993.53	1117.84	1048.06	1025.7	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2596.98	2538.45	2341.19	1970.13	1530.08	1012.11	677.01	705.57	1094.31	1627.57	2120.42	2548.26	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5280.94	(98)
Space heating requirement in kWh/m²/year	24.14	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1591.95	1253.24	1278.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.96	0.94	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1498.19	1207.04	1202.66	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2988.46	2810.38	2382.8	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1072.99	1192.89	878.03	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	3143.91	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.77	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	205.89	228.9	168.48	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	603.26	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	2.76	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1125.33	852.99	647.11	280.02	91.37	0	0	0	0	379.24	772.1	1132.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	661.96	501.76	380.65	164.72	53.75	0	0	0	0	223.08	454.17	666.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	3106.43	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

202.98	178.39	186.11	165.13	160.59	141.71	134.41	149.82	150.28	171.31	183.29	197.52

Total = Sum(219a)$_{1...12}$ = 2021.55 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=

0	0	0	0	0	34.66	38.53	28.36	0	0	0	0

Total = Sum(221)$_{6...8}$ = 101.56 (221)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3106.43
Water heating fuel used		2021.55
Space cooling fuel used		101.56
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	666.49	(230a)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		666.49 (231)
Electricity for lighting		611.71 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6507.74 (338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	409.74 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 – (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	266.64 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.4 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	87.91 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	80.68 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		858.37 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.37	(257)
SAP rating (Section 12)		80.93	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	1612.24	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1049.19	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2661.43	(265)
Space cooling	(221) x		0.519	=	52.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	345.91	(267)
Electricity for lighting	(232) x		0.519	=	317.48	(268)
Total CO2, kg/year		sum of (265)…(271) =			3377.52	(272)
CO2 emissions per m²		(272) ÷ (4) =			15.44	(273)
EI rating (section 14)					83	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	9536.75	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6206.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				15742.92	(265)
Space cooling	(221) x		3.07	=	311.79	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	2046.12	(267)
Electricity for lighting	(232) x		0	=	1877.94	(268)
'Total Primary Energy		sum of (265)…(271) =			19978.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			91.34	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	218.74	(1a) x	2.7	(2a) =	590.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	218.74	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		590.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.07	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.32	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 2			18.52	x1/[1/(1.5)+ 0.04] =	26.21			(27)
Windows Type 3			13.42	x1/[1/(1.5)+ 0.04] =	18.99			(27)
Windows Type 4			2.89	x1/[1/(1.5)+ 0.04] =	4.09			(27)
Walls	115.29	54.69	60.6	x 0.18 =	10.91			(29)
Total area of elements, m²			115.29					(31)
Party wall			40.89	x 0 =	0			(32)
Party wall			40.3	x 0 =	0			(32)
Party floor			218.74					(32a)
Party ceiling			218.74					(32b)
Internal wall **			354.24					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 88.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 45033.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.5 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 97.8 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	111.13	110.6	110.08	107.63	107.18	105.05	105.05	104.65	105.87	107.18	108.1	109.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	208.94	208.4	207.88	205.44	204.98	202.85	202.85	202.45	203.67	204.98	205.91	206.87	

Average = Sum(39)$_{1...12}$ /12= 205.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.03 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	116.68	112.44	108.2	103.95	99.71	95.47	95.47	99.71	103.95	108.2	112.44	116.68	

Total = Sum(44)$_{1...12}$ = 1272.89 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.04	151.34	156.17	136.15	130.64	112.73	104.46	119.87	121.3	141.37	154.31	167.58	

Total = Sum(45)$_{1...12}$ = 1668.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.96	22.7	23.43	20.42	19.6	16.91	15.67	17.98	18.2	21.21	23.15	25.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	

Output from water heater (annual)$_{1...12}$ — 2258.75 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.61	86.52	92	84.05	83.51	76.26	74.81	79.93	79.11	87.08	90.09	95.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	151.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	34.64	30.76	25.02	18.94	14.16	11.95	12.92	16.79	22.53	28.61	33.39	35.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	388.52	392.56	382.4	360.77	333.47	307.81	290.66	286.63	296.79	318.42	345.72	371.38	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	38.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	-121.05	(71)

Water heating gains (Table 5)

(72)m=	131.19	128.74	123.65	116.74	112.25	105.92	100.55	107.43	109.88	117.04	125.13	128.75	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	625.75	623.46	602.47	567.84	531.27	497.08	475.52	482.25	500.6	535.47	575.64	607.13	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	13.42	x	10.63	x	0.63	x	0.7	=	43.61	(74)
North	0.9x	0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x	0.77	x	13.42	x	20.32	x	0.63	x	0.7	=	83.34	(74)
North	0.9x	0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x	0.77	x	13.42	x	34.53	x	0.63	x	0.7	=	141.62	(74)
North	0.9x	0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x	0.77	x	13.42	x	55.46	x	0.63	x	0.7	=	227.48	(74)
North	0.9x	0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x	0.77	x	13.42	x	74.72	x	0.63	x	0.7	=	306.43	(74)
North	0.9x	0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x	0.77	x	13.42	x	79.99	x	0.63	x	0.7	=	328.05	(74)
North	0.9x	0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x	0.77	x	13.42	x	74.68	x	0.63	x	0.7	=	306.27	(74)
North	0.9x	0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x	0.77	x	13.42	x	59.25	x	0.63	x	0.7	=	242.99	(74)
North	0.9x	0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x	0.77	x	13.42	x	41.52	x	0.63	x	0.7	=	170.27	(74)
North	0.9x	0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x	0.77	x	13.42	x	24.19	x	0.63	x	0.7	=	99.21	(74)
North	0.9x	0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x	0.77	x	13.42	x	13.12	x	0.63	x	0.7	=	53.8	(74)
North	0.9x	0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x	0.77	x	13.42	x	8.86	x	0.63	x	0.7	=	36.36	(74)
North	0.9x	0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
Northeast	0.9x	0.77	x	18.52	x	11.28	x	0.63	x	0.7	=	63.86	(75)
Northeast	0.9x	0.77	x	18.52	x	22.97	x	0.63	x	0.7	=	129.99	(75)
Northeast	0.9x	0.77	x	18.52	x	41.38	x	0.63	x	0.7	=	234.2	(75)
Northeast	0.9x	0.77	x	18.52	x	67.96	x	0.63	x	0.7	=	384.63	(75)
Northeast	0.9x	0.77	x	18.52	x	91.35	x	0.63	x	0.7	=	517.01	(75)
Northeast	0.9x	0.77	x	18.52	x	97.38	x	0.63	x	0.7	=	551.19	(75)
Northeast	0.9x	0.77	x	18.52	x	91.1	x	0.63	x	0.7	=	515.63	(75)
Northeast	0.9x	0.77	x	18.52	x	72.63	x	0.63	x	0.7	=	411.06	(75)
Northeast	0.9x	0.77	x	18.52	x	50.42	x	0.63	x	0.7	=	285.38	(75)
Northeast	0.9x	0.77	x	18.52	x	28.07	x	0.63	x	0.7	=	158.86	(75)
Northeast	0.9x	0.77	x	18.52	x	14.2	x	0.63	x	0.7	=	80.35	(75)
Northeast	0.9x	0.77	x	18.52	x	9.21	x	0.63	x	0.7	=	52.15	(75)
Northwest	0.9x	0.77	x	19.86	x	11.28	x	0.63	x	0.7	=	68.48	(81)
Northwest	0.9x	0.77	x	19.86	x	22.97	x	0.63	x	0.7	=	139.4	(81)
Northwest	0.9x	0.77	x	19.86	x	41.38	x	0.63	x	0.7	=	251.15	(81)
Northwest	0.9x	0.77	x	19.86	x	67.96	x	0.63	x	0.7	=	412.46	(81)
Northwest	0.9x	0.77	x	19.86	x	91.35	x	0.63	x	0.7	=	554.42	(81)

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Northwest	0.9x	0.77	x	19.86	x	97.38	x	0.63	x	0.7	=	591.07	(81)
Northwest	0.9x	0.77	x	19.86	x	91.1	x	0.63	x	0.7	=	552.94	(81)
Northwest	0.9x	0.77	x	19.86	x	72.63	x	0.63	x	0.7	=	440.81	(81)
Northwest	0.9x	0.77	x	19.86	x	50.42	x	0.63	x	0.7	=	306.03	(81)
Northwest	0.9x	0.77	x	19.86	x	28.07	x	0.63	x	0.7	=	170.35	(81)
Northwest	0.9x	0.77	x	19.86	x	14.2	x	0.63	x	0.7	=	86.17	(81)
Northwest	0.9x	0.77	x	19.86	x	9.21	x	0.63	x	0.7	=	55.93	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.35	370.68	657.47	1073.55	1443.86	1540.95	1440.79	1147.19	798.35	449.79	231.91	152.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	811.09	994.14	1259.93	1641.39	1975.12	2038.03	1916.31	1629.44	1298.95	985.25	807.54	759.39	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.97	0.84	0.62	0.46	0.56	0.89	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.95	20.22	20.6	20.89	20.99	21	20.99	20.89	20.49	20.08	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.13	20.14	20.14	20.14	20.15	20.14	20.14	20.13	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.96	0.79	0.54	0.37	0.46	0.83	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.7	19.09	19.65	20.03	20.13	20.14	20.14	20.04	19.5	18.91	18.47	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.27	19.6	20.08	20.42	20.52	20.53	20.53	20.43	19.95	19.44	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.81	0.58	0.41	0.51	0.85	0.99	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	810.85	993.1	1252.57	1570.68	1599.7	1179.74	794.99	828.47	1108.12	975.94	806.92	759.24	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3090.25	2994.2	2724.06	2297.4	1787.46	1201.01	797.43	835.95	1288.49	1915.57	2540.88	3076.16	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	

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TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8469.65	(98)
Space heating requirement in kWh/m²/year	38.72	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
1695.87	1344.74	1094.78	523.24	139.69	0	0	0	0	699.09	1248.45	1723.79	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
1813.76	1438.22	1170.89	559.62	149.4	0	0	0	0	747.69	1335.24	1843.62	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$=	9058.45	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=												0	(215)

Water heating

Output from water heater (calculated above)													
	223.13	196.58	206.26	184.63	180.73	161.21	154.55	169.96	169.78	191.46	202.79	217.67	
Efficiency of water heater												79.8	(216)
(217)m=	89.11	88.98	88.62	87.44	84.14	79.8	79.8	79.8	79.8	87.96	88.84	89.16	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	250.39	220.93	232.76	211.14	214.81	202.02	193.68	212.99	212.76	217.66	228.28	244.13	
Total = Sum(219a)$_{1...12}$ =												2641.53	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		9058.45	
Water heating fuel used		2641.53	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		611.71	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		12386.69	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	1956.63	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	570.57	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2527.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	317.48	(268)
Total CO2, kg/year	sum of (265)…(271) =			2883.6	(272)

TER = 19.54 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 40 Flat 40 01

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	779.59	**(P1)**
Transmission heat loss coefficient:	103.6	
Summer heat loss coefficient:	883.23	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North West (NW)	0	1
North East (NE)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North West (NW)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North West (NW)	0.9 x	33.34	89.66	0.4	0.8	0.9	774.78	
North East (NE)	0.9 x	31.09	89.66	0.4	0.8	0.9	722.49	
North (N)	0.9 x	22.53	73.49	0.4	1	0.9	536.47	
North (N GLAZED DOOR)	0.9 x	4.85	73.49	0.4	0.7	0.9	80.84	
						Total	2114.57	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	690.26	661.71	672.26	
Total summer gains	3022.94	2776.28	2328.33	**(P5)**
Summer gain/loss ratio	3.42	3.14	2.64	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.42	20.84	20.24	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Not significant**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:13

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 121.32m²

Site Reference : P1785 St Michaels

Plot Reference: Level 40 Flat 40 02

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	19.04 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.47 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.1 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	32.6 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.87 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: East	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 40 Flat 40 02

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	121.32 m²	2.7 m

Living area:	62.23 m² (fraction 0.513)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
E	16mm or more	0.8	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
E		OPAQUE CURT WALL	East	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	55.49	46.1	9.39	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	44.87						N/A
PARTY CEILING	121.32						N/A
PARTY FLOOR	121.32						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0736

	Length	Psi-value		
[Approved]	28.1	0.05	E4	Jamb
[Approved]	30.74	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.25	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	60.91	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 105.55 (fraction 0.870)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32	(1a) x	2.7	(2a) =	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x	1/[1/(1)+ 0.04]	=	9.31			(27)
Windows Type 2			11.79	x	1/[1/(1)+ 0.04]	=	11.34			(27)
Windows Type 3			1.59	x	1/[1/(1)+ 0.04]	=	1.53			(27)
Windows Type 4			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 5			2.56	x	1/[1/(1)+ 0.04]	=	2.46			(27)
Windows Type 6			16.35	x	1/[1/(1)+ 0.04]	=	15.72			(27)
Windows Type 7			1.57	x	1/[1/(1)+ 0.04]	=	1.51			(27)
Walls	55.49	46.1	9.39	x	0.24	=	2.25			(29)
Total area of elements, m²			55.49							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			44.87	x	0	=	0			(32)
Party floor			121.32							(32a)
Party ceiling			121.32							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.58 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25283.07 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 4.09 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.67 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.4	38.88	38.36	35.74	35.22	32.6	32.6	32.07	33.64	35.22	36.26	37.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.07	89.55	89.02	86.41	85.88	83.26	83.26	82.74	84.31	85.88	86.93	87.98	

Average = Sum(39)$_{1...12}$ /12= 86.27 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.74	0.73	0.71	0.71	0.69	0.69	0.68	0.69	0.71	0.72	0.73	

Average = Sum(40)$_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.61 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Output from water heater (annual)$_{1...12}$ — 1962.51 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.46	70.18	74.05	66.85	65.86	59.34	57.46	62.4	62.09	69.3	72.68	77.7	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	172.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	63.95	56.8	46.19	34.97	26.14	22.07	23.85	31	41.6	52.82	61.65	65.73	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	428.24	432.69	421.49	397.65	367.55	339.27	320.38	315.93	327.13	350.97	381.06	409.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	55.08	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	106.8	104.43	99.52	92.85	88.52	82.42	77.23	83.88	86.24	93.14	100.94	104.44	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	711.43	706.36	679.65	637.91	594.66	556.2	533.9	543.25	567.41	609.38	656.1	691.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
East 0.9x	0.77	x	16.35	x	19.64	x	0.4	x	0.8	=	71.21	(76)
East 0.9x	0.77	x	16.35	x	38.42	x	0.4	x	0.8	=	139.3	(76)
East 0.9x	0.77	x	16.35	x	63.27	x	0.4	x	0.8	=	229.41	(76)

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East	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	0.8	=	334.59	(76)
East	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	0.8	=	410.05	(76)
East	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	0.8	=	419.76	(76)
East	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	0.8	=	399.63	(76)
East	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	0.8	=	343.27	(76)
East	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	0.8	=	266.82	(76)
East	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	0.8	=	165.3	(76)
East	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	0.8	=	88.79	(76)
East	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	0.8	=	58.56	(76)
Southeast	0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast	0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast	0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)
Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)

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South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	233.43	424.61	645.3	895.38	1081.67	1106.18	1053.19	910.8	732.17	487.34	284.69	196.38	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	944.86	1130.97	1324.94	1533.29	1676.33	1662.38	1587.09	1454.05	1299.59	1096.72	940.79	888.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.86	0.77	0.62	0.46	0.32	0.23	0.26	0.43	0.7	0.87	0.93	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.78	20.32	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.31	20.31	20.33	20.33	20.35	20.35	20.36	20.35	20.33	20.33	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.85	0.75	0.59	0.43	0.29	0.2	0.22	0.4	0.67	0.85	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.84	19.25	19.71	20.12	20.28	20.34	20.35	20.35	20.32	20.07	19.44	18.8	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.38	19.74	20.13	20.48	20.62	20.68	20.68	20.68	20.65	20.43	19.89	19.35	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.84	0.74	0.6	0.44	0.3	0.21	0.24	0.41	0.67	0.84	0.91	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	844.34	945.75	985.21	913.63	741	501.55	339.07	353.02	538.27	736.67	792.25	805.14	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1358.7	1328.54	1213.65	1000.63	766.21	505.89	339.96	354.44	552.33	844.33	1112.16	1332.69	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1594.2 (98)

Space heating requirement in kWh/m²/year 13.14 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	782.68	616.15	628.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	763.57	607.91	616.98	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1849.14	1764.9	1607.82	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	781.61	860.8	737.18	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 2379.6 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	170	187.23	160.34	0	0	0	0	

Total = Sum(107)$_{6...8}$ = 517.57 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.27 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) — (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 — (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 — 170 (206)

Efficiency of secondary/supplementary heating system, % — 0 (208)

Cooling System Energy Efficiency Ratio — 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	382.69	257.23	169.95	62.64	18.75	0	0	0	0	80.1	230.34	392.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	225.11	151.31	99.97	36.85	11.03	0	0	0	0	47.12	135.49	230.88	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 937.77 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59

Efficiency of water heater — 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.86	173.03	180.59	160.31	155.96	137.72	130.71	145.58	145.99	166.31	177.84	191.59	

Total = Sum(219a)$_{1...12}$ = 1962.51 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	28.62	31.52	26.99	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 87.13 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		937.77	
Water heating fuel used		1962.51	
Space cooling fuel used		87.13	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	369.66		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	369.66	(231)
Electricity for lighting		451.74	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3808.8	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	123.69	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	258.85	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	11.49	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	48.76	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.58	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				502.38	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.27	(257)
SAP rating (Section 12)		82.3	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	486.7	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1018.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1505.24	(265)
Space cooling	(221)	x	0.519	=	45.22	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	191.85	(267)
Electricity for lighting	(232)	x	0.519	=	234.45	(268)
Total CO2, kg/year		sum of (265)…(271) =			1976.77	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.29	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	2878.94	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6024.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8903.83	(265)
Space cooling	(221)	x	3.07	=	267.5	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	1134.84	(267)
Electricity for lighting	(232)	x	0	=	1386.84	(268)
'Total Primary Energy		sum of (265)…(271) =			11693.01	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			96.38	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 02

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121.32	(1a) x	2.7	(2a) =	327.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121.32	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		327.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.37	x1/[1/(1.5)+ 0.04] =	9.01			(27)
Windows Type 2			7.76	x1/[1/(1.5)+ 0.04] =	10.98			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 5			1.68	x1/[1/(1.5)+ 0.04] =	2.38			(27)
Windows Type 6			10.76	x1/[1/(1.5)+ 0.04] =	15.23			(27)
Windows Type 7			1.03	x1/[1/(1.5)+ 0.04] =	1.46			(27)
Walls	55.49	30.33	25.16	x 0.18 =	4.53			(29)
Total area of elements, m²			55.49					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			44.87	x 0 =	0			(32)
Party floor			121.32					(32a)
Party ceiling			121.32					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.45 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25503.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 51.33 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.36	61.07	60.79	59.49	59.24	58.1	58.1	57.89	58.54	59.24	59.74	60.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.68	112.4	112.12	110.82	110.57	109.43	109.43	109.22	109.87	110.57	111.07	111.58	

Average = Sum(39)$_{1...12}$ /12= 110.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.92	0.91	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.32 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.55	108.46	104.37	100.28	96.18	92.09	92.09	96.18	100.28	104.37	108.46	112.55	

Total = Sum(44)$_{1...12}$ = 1227.86 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.91	145.98	150.64	131.33	126.02	108.74	100.77	115.63	117.01	136.37	148.86	161.65	

Total = Sum(45)$_{1...12}$ = 1609.92 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.04	21.9	22.6	19.7	18.9	16.31	15.12	17.34	17.55	20.46	22.33	24.25	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	

Output from water heater (annual)$_{1...12}$	2199.71	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.57	84.73	90.16	82.45	81.97	74.94	73.58	78.52	77.69	85.42	88.28	93.82	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	143.41	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.58	22.72	18.48	13.99	10.46	8.83	9.54	12.4	16.64	21.13	24.66	26.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	286.92	289.9	282.4	266.42	246.26	227.31	214.65	211.67	219.18	235.15	255.31	274.26	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	-114.73	(71)

Water heating gains (Table 5)

(72)m=	128.46	126.09	121.19	114.51	110.18	104.08	98.9	105.54	107.9	114.81	122.6	126.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	509.98	507.74	491.08	463.95	435.92	409.24	392.11	398.64	412.74	440.11	471.6	495.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.68	x	10.63	x	0.63	x	0.7	=	5.46	(74)
North	0.9x	0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35	(74)
North	0.9x	0.77	x	1.68	x	20.32	x	0.63	x	0.7	=	10.43	(74)
North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4	(74)
North	0.9x	0.77	x	1.68	x	34.53	x	0.63	x	0.7	=	17.73	(74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87	(74)
North	0.9x	0.77	x	1.68	x	55.46	x	0.63	x	0.7	=	28.48	(74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46	(74)
North	0.9x	0.77	x	1.68	x	74.72	x	0.63	x	0.7	=	38.36	(74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52	(74)
North	0.9x	0.77	x	1.68	x	79.99	x	0.63	x	0.7	=	41.07	(74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18	(74)
North	0.9x	0.77	x	1.68	x	74.68	x	0.63	x	0.7	=	38.34	(74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.68	x	59.25	x	0.63	x	0.7	=	30.42	(74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	1.68	x	41.52	x	0.63	x	0.7	=	21.32	(74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07	(74)
North	0.9x	0.77	x	1.68	x	24.19	x	0.63	x	0.7	=	12.42	(74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61	(74)
North	0.9x	0.77	x	1.68	x	13.12	x	0.63	x	0.7	=	6.73	(74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13	(74)
North	0.9x	0.77	x	1.68	x	8.86	x	0.63	x	0.7	=	4.55	(74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79	(74)
Northeast	0.9x	0.77	x	7.76	x	11.28	x	0.63	x	0.7	=	26.76	(75)
Northeast	0.9x	0.77	x	7.76	x	22.97	x	0.63	x	0.7	=	54.47	(75)
Northeast	0.9x	0.77	x	7.76	x	41.38	x	0.63	x	0.7	=	98.13	(75)
Northeast	0.9x	0.77	x	7.76	x	67.96	x	0.63	x	0.7	=	161.16	(75)
Northeast	0.9x	0.77	x	7.76	x	91.35	x	0.63	x	0.7	=	216.63	(75)
Northeast	0.9x	0.77	x	7.76	x	97.38	x	0.63	x	0.7	=	230.95	(75)
Northeast	0.9x	0.77	x	7.76	x	91.1	x	0.63	x	0.7	=	216.05	(75)
Northeast	0.9x	0.77	x	7.76	x	72.63	x	0.63	x	0.7	=	172.24	(75)
Northeast	0.9x	0.77	x	7.76	x	50.42	x	0.63	x	0.7	=	119.58	(75)
Northeast	0.9x	0.77	x	7.76	x	28.07	x	0.63	x	0.7	=	66.56	(75)
Northeast	0.9x	0.77	x	7.76	x	14.2	x	0.63	x	0.7	=	33.67	(75)
Northeast	0.9x	0.77	x	7.76	x	9.21	x	0.63	x	0.7	=	21.85	(75)
East	0.9x	0.77	x	10.76	x	19.64	x	0.63	x	0.7	=	64.58	(76)
East	0.9x	0.77	x	10.76	x	38.42	x	0.63	x	0.7	=	126.34	(76)
East	0.9x	0.77	x	10.76	x	63.27	x	0.63	x	0.7	=	208.07	(76)

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TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	10.76	x	92.28	x	0.63	x	0.7	=	303.45	(76)
East	0.9x	0.77	x	10.76	x	113.09	x	0.63	x	0.7	=	371.89	(76)
East	0.9x	0.77	x	10.76	x	115.77	x	0.63	x	0.7	=	380.7	(76)
East	0.9x	0.77	x	10.76	x	110.22	x	0.63	x	0.7	=	362.44	(76)
East	0.9x	0.77	x	10.76	x	94.68	x	0.63	x	0.7	=	311.33	(76)
East	0.9x	0.77	x	10.76	x	73.59	x	0.63	x	0.7	=	241.99	(76)
East	0.9x	0.77	x	10.76	x	45.59	x	0.63	x	0.7	=	149.92	(76)
East	0.9x	0.77	x	10.76	x	24.49	x	0.63	x	0.7	=	80.53	(76)
East	0.9x	0.77	x	10.76	x	16.15	x	0.63	x	0.7	=	53.11	(76)
Southeast	0.9x	0.77	x	6.37	x	36.79	x	0.63	x	0.7	=	71.63	(77)
Southeast	0.9x	0.77	x	6.37	x	62.67	x	0.63	x	0.7	=	122.01	(77)
Southeast	0.9x	0.77	x	6.37	x	85.75	x	0.63	x	0.7	=	166.94	(77)
Southeast	0.9x	0.77	x	6.37	x	106.25	x	0.63	x	0.7	=	206.85	(77)
Southeast	0.9x	0.77	x	6.37	x	119.01	x	0.63	x	0.7	=	231.68	(77)
Southeast	0.9x	0.77	x	6.37	x	118.15	x	0.63	x	0.7	=	230.01	(77)
Southeast	0.9x	0.77	x	6.37	x	113.91	x	0.63	x	0.7	=	221.75	(77)
Southeast	0.9x	0.77	x	6.37	x	104.39	x	0.63	x	0.7	=	203.22	(77)
Southeast	0.9x	0.77	x	6.37	x	92.85	x	0.63	x	0.7	=	180.76	(77)
Southeast	0.9x	0.77	x	6.37	x	69.27	x	0.63	x	0.7	=	134.85	(77)
Southeast	0.9x	0.77	x	6.37	x	44.07	x	0.63	x	0.7	=	85.79	(77)
Southeast	0.9x	0.77	x	6.37	x	31.49	x	0.63	x	0.7	=	61.3	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.68	x	46.75	x	0.63	x	0.7	=	24	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.68	x	76.57	x	0.63	x	0.7	=	39.31	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.68	x	97.53	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.68	x	110.23	x	0.63	x	0.7	=	56.6	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.68	x	114.87	x	0.63	x	0.7	=	58.98	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.68	x	110.55	x	0.63	x	0.7	=	56.76	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.68	x	108.01	x	0.63	x	0.7	=	55.46	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.68	x	104.89	x	0.63	x	0.7	=	53.86	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.68	x	101.89	x	0.63	x	0.7	=	52.31	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.68	x	82.59	x	0.63	x	0.7	=	42.4	(78)

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South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.68	x	55.42	x	0.63	x	0.7	=	28.45	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.68	x	40.4	x	0.63	x	0.7	=	20.74	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	210.78	383.53	583.11	809.37	977.93	1000.14	952.21	823.38	661.72	440.26	257.09	177.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	720.77	891.27	1074.19	1273.32	1413.85	1409.38	1344.32	1222.01	1074.46	880.37	728.7	672.99	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.7	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.25	20.53	20.82	20.96	21	21	21	20.98	20.74	20.34	20.03	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.61	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.88	19.16	19.56	19.96	20.13	20.16	20.17	20.17	20.15	19.87	19.29	18.84	(90)

fLA = Living area ÷ (4) = 0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.72	20.06	20.4	20.56	20.59	20.59	20.59	20.57	20.32	19.83	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	718.4	881.41	1031.31	1093.72	944.32	652.34	436.71	457.36	690.72	817.73	722.26	671.48	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1711.46	1666.06	1519.97	1274.59	979.16	655.56	437.01	458.05	711.1	1074.5	1413.77	1701.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3241.14 (98)

Space heating requirement in kWh/m²/year 26.72 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	738.83	527.28	363.57	130.22	25.92	0	0	0	0	191.04	497.88	766.39	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	790.2	563.94	388.84	139.28	27.72	0	0	0	0	204.32	532.5	819.67	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3466.46 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	217.01	191.23	200.73	179.81	176.11	157.22	150.86	165.72	165.49	186.46	197.33	211.74	
Efficiency of water heater													79.8 (216)
(217)m=	87.83	87.38	86.38	83.97	81.03	79.8	79.8	79.8	79.8	84.88	87.18	87.95	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	247.08	218.84	232.39	214.14	217.34	197.02	189.05	207.67	207.38	219.68	226.34	240.76	

Total = Sum(219a)$_{1...12}$ = 2617.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3466.46
Water heating fuel used		2617.68
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		451.74 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6610.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	748.76	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.42	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1314.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	234.45	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.55	(272)

TER = 19.04 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 40 Flat 40 02

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	432.38	**(P1)**
Transmission heat loss coefficient:	50.7	
Summer heat loss coefficient:	483.05	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
East (E)	0	1
North (N)	0	1

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Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
East (E)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
East (E)	0.9 x	16.35	108.47	0.4	0.8	0.9	459.68	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1211.46	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	556.2	533.9	543.25	
Total summer gains	1868.53	1745.36	1573.92	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	3.87	3.61	3.26	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.87	21.31	20.86	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:08

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 236.67m²
Site Reference : P1785 St Michaels **Plot Reference:** Level 40 Flat 40 03
Address :

Client Details:

Name:
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	14.49 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.66 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	29.9 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.84 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	33.34m²
Windows facing: South West	30.67m²
Windows facing: South	22.53m²
Windows facing: South	4.85m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 40 Flat 40 03

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	236.67 m²	2.7 m

Living area:	98.45 m² (fraction 0.416)
Front of dwelling faces:	North

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SW	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	33.34	1
SW	16mm or more	0.8	0.4	1	30.67	1
S	16mm or more	1	0.4	1	22.53	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	4.85	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South West	0	0
SW		OPAQUE CURT WALL	South West	0	0
S		OPAQUE CURT WALL	South	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	114.87	91.39	23.48	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	391.77						N/A
Party Elements							
PARTY WALLS	35.74						N/A
WALLS TO CORRIDOR	28.53						N/A
PARTY CEILING	236.67						N/A

SAP Input

PARTY FLOOR	236.67	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0843

	Length	Psi-value		
[Approved]	79.2	0.05	E4	Jamb
[Approved]	74.02	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	11.06	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	47.58	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

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Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 205.31 (fraction 0.867)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903
Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			33.34	x 1/[1/(1)+ 0.04]		=	32.06			(27)
Windows Type 2			30.67	x 1/[1/(1)+ 0.04]		=	29.49			(27)
Windows Type 3			22.53	x 1/[1/(1)+ 0.04]		=	21.66			(27)
Windows Type 4			4.85	x 1/[1/(1)+ 0.04]		=	4.66			(27)
Walls	114.87	91.39	23.48	x	0.24	=	5.64			(29)
Total area of elements, m²			114.87							(31)
Party wall			35.74	x	0	=	0			(32)
Party wall			28.53	x	0	=	0			(32)
Party floor			236.67							(32a)
Party ceiling			236.67							(32b)
Internal wall **			391.77							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.51 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 47740.65 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.69 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.2 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	76.87	75.85	74.83	69.72	68.7	63.59	63.59	62.57	65.63	68.7	70.74	72.78	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	180.07	179.05	178.02	172.92	171.9	166.79	166.79	165.77	168.83	171.9	173.94	175.98	

Average = Sum(39)$_{1...12}$ /12= 172.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.76	0.76	0.75	0.73	0.73	0.7	0.7	0.7	0.71	0.73	0.73	0.74	

Average = Sum(40)$_{1...12}$ /12= 0.73 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.97 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4	

Output from water heater (annual)$_{1...12}$ — 2030.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.79	72.22	76.15	68.69	67.62	60.86	58.87	64.02	63.73	71.21	74.76	79.97	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	182.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	90.2	80.11	65.15	49.32	36.87	31.13	33.63	43.72	58.68	74.51	86.96	92.7	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	604.01	610.28	594.48	560.86	518.41	478.52	451.87	445.6	461.4	495.02	537.47	577.36	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	56.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	109.93	107.47	102.36	95.4	90.89	84.53	79.13	86.05	88.51	95.71	103.84	107.48	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	921.48	915.2	879.33	822.92	763.51	711.52	681.97	692.71	725.93	782.58	845.6	894.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	22.53	x	46.75	x	0.4	x	1	=	291.98	(78)
South	0.9x	0.77	x	4.85	x	46.75	x	0.4	x	0.7	=	44	(78)
South	0.9x	0.77	x	22.53	x	76.57	x	0.4	x	1	=	478.19	(78)
South	0.9x	0.77	x	4.85	x	76.57	x	0.4	x	0.7	=	72.06	(78)
South	0.9x	0.77	x	22.53	x	97.53	x	0.4	x	1	=	609.13	(78)
South	0.9x	0.77	x	4.85	x	97.53	x	0.4	x	0.7	=	91.79	(78)
South	0.9x	0.77	x	22.53	x	110.23	x	0.4	x	1	=	688.45	(78)
South	0.9x	0.77	x	4.85	x	110.23	x	0.4	x	0.7	=	103.74	(78)
South	0.9x	0.77	x	22.53	x	114.87	x	0.4	x	1	=	717.41	(78)
South	0.9x	0.77	x	4.85	x	114.87	x	0.4	x	0.7	=	108.1	(78)
South	0.9x	0.77	x	22.53	x	110.55	x	0.4	x	1	=	690.41	(78)
South	0.9x	0.77	x	4.85	x	110.55	x	0.4	x	0.7	=	104.04	(78)
South	0.9x	0.77	x	22.53	x	108.01	x	0.4	x	1	=	674.57	(78)
South	0.9x	0.77	x	4.85	x	108.01	x	0.4	x	0.7	=	101.65	(78)
South	0.9x	0.77	x	22.53	x	104.89	x	0.4	x	1	=	655.1	(78)
South	0.9x	0.77	x	4.85	x	104.89	x	0.4	x	0.7	=	98.72	(78)
South	0.9x	0.77	x	22.53	x	101.89	x	0.4	x	1	=	636.31	(78)
South	0.9x	0.77	x	4.85	x	101.89	x	0.4	x	0.7	=	95.88	(78)
South	0.9x	0.77	x	22.53	x	82.59	x	0.4	x	1	=	515.77	(78)
South	0.9x	0.77	x	4.85	x	82.59	x	0.4	x	0.7	=	77.72	(78)
South	0.9x	0.77	x	22.53	x	55.42	x	0.4	x	1	=	346.1	(78)
South	0.9x	0.77	x	4.85	x	55.42	x	0.4	x	0.7	=	52.15	(78)
South	0.9x	0.77	x	22.53	x	40.4	x	0.4	x	1	=	252.3	(78)
South	0.9x	0.77	x	4.85	x	40.4	x	0.4	x	0.7	=	38.02	(78)
Southwest	0.9x	0.77	x	33.34	x	36.79		0.4	x	0.8	=	272.03	(79)
Southwest	0.9x	0.77	x	30.67	x	36.79		0.4	x	0.8	=	250.25	(79)
Southwest	0.9x	0.77	x	33.34	x	62.67		0.4	x	0.8	=	463.38	(79)
Southwest	0.9x	0.77	x	30.67	x	62.67		0.4	x	0.8	=	426.27	(79)
Southwest	0.9x	0.77	x	33.34	x	85.75		0.4	x	0.8	=	634.01	(79)
Southwest	0.9x	0.77	x	30.67	x	85.75		0.4	x	0.8	=	583.24	(79)
Southwest	0.9x	0.77	x	33.34	x	106.25		0.4	x	0.8	=	785.57	(79)
Southwest	0.9x	0.77	x	30.67	x	106.25		0.4	x	0.8	=	722.66	(79)
Southwest	0.9x	0.77	x	33.34	x	119.01		0.4	x	0.8	=	879.9	(79)
Southwest	0.9x	0.77	x	30.67	x	119.01		0.4	x	0.8	=	809.44	(79)
Southwest	0.9x	0.77	x	33.34	x	118.15		0.4	x	0.8	=	873.54	(79)
Southwest	0.9x	0.77	x	30.67	x	118.15		0.4	x	0.8	=	803.58	(79)
Southwest	0.9x	0.77	x	33.34	x	113.91		0.4	x	0.8	=	842.19	(79)
Southwest	0.9x	0.77	x	30.67	x	113.91		0.4	x	0.8	=	774.74	(79)
Southwest	0.9x	0.77	x	33.34	x	104.39		0.4	x	0.8	=	771.81	(79)
Southwest	0.9x	0.77	x	30.67	x	104.39		0.4	x	0.8	=	710	(79)
Southwest	0.9x	0.77	x	33.34	x	92.85		0.4	x	0.8	=	686.5	(79)

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Southwest 0.9x	0.77	x	30.67	x	92.85	0.4	x	0.8	=	631.52	(79)
Southwest 0.9x	0.77	x	33.34	x	69.27	0.4	x	0.8	=	512.13	(79)
Southwest 0.9x	0.77	x	30.67	x	69.27	0.4	x	0.8	=	471.11	(79)
Southwest 0.9x	0.77	x	33.34	x	44.07	0.4	x	0.8	=	325.83	(79)
Southwest 0.9x	0.77	x	30.67	x	44.07	0.4	x	0.8	=	299.74	(79)
Southwest 0.9x	0.77	x	33.34	x	31.49	0.4	x	0.8	=	232.8	(79)
Southwest 0.9x	0.77	x	30.67	x	31.49	0.4	x	0.8	=	214.16	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	858.26	1439.89	1918.16	2300.42	2514.85	2471.56	2393.14	2235.62	2050.21	1576.74	1023.83	737.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	1779.74	2355.09	2797.49	3123.34	3278.36	3183.08	3075.12	2928.33	2776.14	2359.31	1869.43	1632.17	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.85	0.74	0.61	0.47	0.33	0.24	0.26	0.41	0.66	0.87	0.94	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.81	20.22	20.56	20.82	20.94	20.99	21	21	20.97	20.8	20.3	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.29	20.29	20.29	20.31	20.32	20.34	20.34	20.34	20.33	20.32	20.31	20.3	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.92	0.83	0.72	0.58	0.44	0.3	0.2	0.22	0.37	0.63	0.85	0.93	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.69	19.27	19.74	20.1	20.25	20.33	20.33	20.34	20.3	20.08	19.4	18.61	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.16	19.67	20.08	20.4	20.54	20.6	20.61	20.61	20.58	20.38	19.77	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.9	0.82	0.72	0.58	0.45	0.31	0.22	0.24	0.39	0.63	0.84	0.92	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	1603.99	1925.85	2003.79	1820.6	1464.6	990.53	666.8	695.28	1070.65	1496.7	1566.57	1498.19	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	2675.7	2643.94	2417.77	1988.88	1519.44	1000.9	668.87	698.15	1094.29	1681.42	2204.1	2619.78	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3180.79	(98)
Space heating requirement in kWh/m²/year	13.44	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1567.81	1234.23	1259.83	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.97	0.98	0.98	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1523.49	1215.53	1236.37	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3600.36	3479.15	3305.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1495.34	1684.14	1539.64	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	4719.12	(104)
Cooled fraction f C = cooled area ÷ (4) =	0.87	(105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	324.3	365.25	333.91	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ =	1023.45	(107)
Space cooling requirement in kWh/m²/year (107) ÷ (4) =	4.32	(108)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	170	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Cooling System Energy Efficiency Ratio	5.94	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	797.35	482.56	308	121.16	40.8	0	0	0	0	137.43	459.02	834.47	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	469.03	283.86	181.18	71.27	24	0	0	0	0	80.84	270.01	490.86	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$=	1871.06	(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$=	0	(215)

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Water heating

Output from water heater (calculated above)

	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Efficiency of water heater: 100 (216)

(217)m= 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.88	179.18	186.93	165.84	161.27	142.3	134.95	150.44	150.92	172.05	184.1	198.4

Total = Sum(219a)$_{1...12}$ = 2030.26 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	54.6	61.49	56.21	0	0	0	0

Total = Sum(221)$_{6...8}$ = 172.3 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1871.06	
Water heating fuel used		2030.26	
Space cooling fuel used		172.3	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	721.12		(230a)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	721.12	(231)
Electricity for lighting		637.15	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5431.89	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	246.79	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	267.79	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	22.73	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	95.12	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	84.04	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				716.47	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.07	(257)
SAP rating (Section 12)		85.1	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	971.08	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	1053.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2024.78	(265)
Space cooling	(221)	x	0.519	=	89.42	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	374.26	(267)
Electricity for lighting	(232)	x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =				2819.15	(272)
CO2 emissions per m²	(272) ÷ (4) =				11.91	(273)
EI rating (section 14)					87	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	5744.14	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6232.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				11977.05	(265)
Space cooling	(221)	x	3.07	=	528.96	(266)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	2213.84	(267)
Electricity for lighting	(232)	x	0	=	1956.05	(268)
'Total Primary Energy	sum of (265)…(271) =				16675.9	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				70.46	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	236.67	(1a) x	2.7	(2a) =	639.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	236.67	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		639.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.06	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.31	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.24	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.31	0.3	0.3	0.27	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			21.58	x1/[1/(1.5)+ 0.04] =	30.54			(27)
Windows Type 2			19.86	x1/[1/(1.5)+ 0.04] =	28.1			(27)
Windows Type 3			14.59	x1/[1/(1.5)+ 0.04] =	20.65			(27)
Windows Type 4			3.14	x1/[1/(1.5)+ 0.04] =	4.44			(27)
Walls	114.87	59.17	55.7	x 0.18 =	10.03			(29)
Total area of elements, m²			114.87					(31)
Party wall			35.74	x 0 =	0			(32)
Party wall			28.53	x 0 =	0			(32)
Party floor			236.67					(32a)
Party ceiling			236.67					(32b)
Internal wall **			391.77					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 93.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 48191.73 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.47 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 103.22 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	115.5	115.11	114.72	112.92	112.59	111.02	111.02	110.73	111.62	112.59	113.27	113.98	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	218.72	218.33	217.95	216.15	215.81	214.24	214.24	213.95	214.85	215.81	216.49	217.2	

Average = Sum(39)$_{1...12}$ /12= 216.15 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.9	0.91	0.91	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.05 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 106.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	117.29	113.03	108.76	104.5	100.23	95.97	95.97	100.23	104.5	108.76	113.03	117.29	

Total = Sum(44)$_{1...12}$ = 1279.54 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	173.94	152.13	156.98	136.86	131.32	113.32	105.01	120.5	121.94	142.11	155.12	168.45	

Total = Sum(45)$_{1...12}$ = 1677.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	26.09	22.82	23.55	20.53	19.7	17	15.75	18.07	18.29	21.32	23.27	25.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54	

Output from water heater (annual)$_{1...12}$ — 2267.46 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.91	86.78	92.27	84.29	83.74	76.46	74.99	80.14	79.32	87.32	90.36	96.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	152.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	36.08	32.04	26.06	19.73	14.75	12.45	13.45	17.49	23.47	29.8	34.78	37.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	404.69	408.89	398.3	375.78	347.34	320.61	302.75	298.55	309.14	331.66	360.1	386.83	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	-121.98	(71)

Water heating gains (Table 5)

(72)m=	131.6	129.13	124.02	117.07	112.55	106.19	100.79	107.71	110.17	117.37	125.5	129.14	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	644.11	641.81	620.13	584.31	546.38	511	488.74	495.5	514.53	550.58	592.13	624.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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South	0.9x	0.77	x	14.59	x	46.75	x	0.63	x	0.7	=	208.46	(78)
South	0.9x	0.77	x	3.14	x	46.75	x	0.63	x	0.7	=	44.86	(78)
South	0.9x	0.77	x	14.59	x	76.57	x	0.63	x	0.7	=	341.41	(78)
South	0.9x	0.77	x	3.14	x	76.57	x	0.63	x	0.7	=	73.48	(78)
South	0.9x	0.77	x	14.59	x	97.53	x	0.63	x	0.7	=	434.89	(78)
South	0.9x	0.77	x	3.14	x	97.53	x	0.63	x	0.7	=	93.6	(78)
South	0.9x	0.77	x	14.59	x	110.23	x	0.63	x	0.7	=	491.52	(78)
South	0.9x	0.77	x	3.14	x	110.23	x	0.63	x	0.7	=	105.78	(78)
South	0.9x	0.77	x	14.59	x	114.87	x	0.63	x	0.7	=	512.2	(78)
South	0.9x	0.77	x	3.14	x	114.87	x	0.63	x	0.7	=	110.23	(78)
South	0.9x	0.77	x	14.59	x	110.55	x	0.63	x	0.7	=	492.92	(78)
South	0.9x	0.77	x	3.14	x	110.55	x	0.63	x	0.7	=	106.08	(78)
South	0.9x	0.77	x	14.59	x	108.01	x	0.63	x	0.7	=	481.61	(78)
South	0.9x	0.77	x	3.14	x	108.01	x	0.63	x	0.7	=	103.65	(78)
South	0.9x	0.77	x	14.59	x	104.89	x	0.63	x	0.7	=	467.71	(78)
South	0.9x	0.77	x	3.14	x	104.89	x	0.63	x	0.7	=	100.66	(78)
South	0.9x	0.77	x	14.59	x	101.89	x	0.63	x	0.7	=	454.3	(78)
South	0.9x	0.77	x	3.14	x	101.89	x	0.63	x	0.7	=	97.77	(78)
South	0.9x	0.77	x	14.59	x	82.59	x	0.63	x	0.7	=	368.24	(78)
South	0.9x	0.77	x	3.14	x	82.59	x	0.63	x	0.7	=	79.25	(78)
South	0.9x	0.77	x	14.59	x	55.42	x	0.63	x	0.7	=	247.1	(78)
South	0.9x	0.77	x	3.14	x	55.42	x	0.63	x	0.7	=	53.18	(78)
South	0.9x	0.77	x	14.59	x	40.4	x	0.63	x	0.7	=	180.13	(78)
South	0.9x	0.77	x	3.14	x	40.4	x	0.63	x	0.7	=	38.77	(78)
Southwest	0.9x	0.77	x	21.58	x	36.79		0.63	x	0.7	=	242.66	(79)
Southwest	0.9x	0.77	x	19.86	x	36.79		0.63	x	0.7	=	223.32	(79)
Southwest	0.9x	0.77	x	21.58	x	62.67		0.63	x	0.7	=	413.34	(79)
Southwest	0.9x	0.77	x	19.86	x	62.67		0.63	x	0.7	=	380.4	(79)
Southwest	0.9x	0.77	x	21.58	x	85.75		0.63	x	0.7	=	565.55	(79)
Southwest	0.9x	0.77	x	19.86	x	85.75		0.63	x	0.7	=	520.47	(79)
Southwest	0.9x	0.77	x	21.58	x	106.25		0.63	x	0.7	=	700.74	(79)
Southwest	0.9x	0.77	x	19.86	x	106.25		0.63	x	0.7	=	644.89	(79)
Southwest	0.9x	0.77	x	21.58	x	119.01		0.63	x	0.7	=	784.89	(79)
Southwest	0.9x	0.77	x	19.86	x	119.01		0.63	x	0.7	=	722.33	(79)
Southwest	0.9x	0.77	x	21.58	x	118.15		0.63	x	0.7	=	779.21	(79)
Southwest	0.9x	0.77	x	19.86	x	118.15		0.63	x	0.7	=	717.11	(79)
Southwest	0.9x	0.77	x	21.58	x	113.91		0.63	x	0.7	=	751.25	(79)
Southwest	0.9x	0.77	x	19.86	x	113.91		0.63	x	0.7	=	691.37	(79)
Southwest	0.9x	0.77	x	21.58	x	104.39		0.63	x	0.7	=	688.47	(79)
Southwest	0.9x	0.77	x	19.86	x	104.39		0.63	x	0.7	=	633.6	(79)
Southwest	0.9x	0.77	x	21.58	x	92.85		0.63	x	0.7	=	612.37	(79)

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Southwest	0.9x	0.77	x	19.86	x	92.85		0.63	x	0.7	=	563.56	(79)
Southwest	0.9x	0.77	x	21.58	x	69.27		0.63	x	0.7	=	456.83	(79)
Southwest	0.9x	0.77	x	19.86	x	69.27		0.63	x	0.7	=	420.42	(79)
Southwest	0.9x	0.77	x	21.58	x	44.07		0.63	x	0.7	=	290.65	(79)
Southwest	0.9x	0.77	x	19.86	x	44.07		0.63	x	0.7	=	267.48	(79)
Southwest	0.9x	0.77	x	21.58	x	31.49		0.63	x	0.7	=	207.67	(79)
Southwest	0.9x	0.77	x	19.86	x	31.49		0.63	x	0.7	=	191.11	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	719.31	1208.62	1614.51	1942.94	2129.65	2095.33	2027.88	1890.44	1728	1324.74	858.41	617.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1363.41	1850.43	2234.64	2527.26	2676.03	2606.33	2516.62	2385.94	2242.53	1875.32	1450.54	1242.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.71	0.52	0.37	0.41	0.64	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.3	20.58	20.83	20.96	20.99	21	21	20.98	20.79	20.35	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.16	20.16	20.16	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.95	0.84	0.66	0.46	0.3	0.34	0.57	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19.24	19.63	19.97	20.12	20.16	20.16	20.16	20.15	19.93	19.31	18.8	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.68	20.03	20.33	20.47	20.51	20.51	20.51	20.5	20.28	19.74	19.3	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.98	0.95	0.85	0.68	0.48	0.33	0.37	0.6	0.9	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	1359.42	1822.08	2115.87	2144.49	1818.6	1257.64	837.2	878.35	1346.37	1689.15	1435.85	1240.29	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	3294.33	3227	2947.92	2470.15	1892.44	1265.55	837.87	879.59	1374.04	2089.87	2737.27	3280.14	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6044.94	(98)
Space heating requirement in kWh/m²/year	25.54	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1439.57	944.11	619.04	234.48	54.94	0	0	0	0	298.13	937.02	1517.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	1539.65	1009.74	662.08	250.78	58.76	0	0	0	0	318.86	1002.16	1623.15	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 6465.18 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	224.03	197.37	207.07	185.34	181.41	161.8	155.1	170.59	170.41	192.2	203.6	218.54

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	88.89	88.45	87.56	85.44	82.06	79.8	79.8	79.8	79.8	85.98	88.38	89

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	252.02	223.15	236.5	216.92	221.09	202.75	194.36	213.77	213.55	223.54	230.35	245.56

Total = Sum(219a)$_{1...12}$ = 2673.55 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		6465.18
Water heating fuel used		2673.55
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		637.15 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9850.88 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	1396.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	577.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1973.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	330.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			2343.57	(272)

TER = 14.49 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 40 Flat 40 03

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	843.49	**(P1)**
Transmission heat loss coefficient:	103.2	
Summer heat loss coefficient:	946.69	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (SE)	0	1
South West (SW)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (SE)	1	0.9	1	0.9	**(P8)**
South West (SW)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SE)	0.9 x	33.34	112.1	0.4	0.8	0.9	968.75	
South West (SW)	0.9 x	30.67	112.1	0.4	0.8	0.9	891.17	
South (S)	0.9 x	22.53	106.3	0.4	1	0.9	775.94	
South (S GLAZED DOOR)	0.9 x	4.85	106.3	0.4	0.7	0.9	116.93	
						Total	2752.78	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	711.52	681.97	692.71	
Total summer gains	3643.69	3434.75	3222.56	**(P5)**
Summer gain/loss ratio	3.85	3.63	3.4	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	19.85	21.33	21	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

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SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:13:03

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 122.24m²

Site Reference : P1785 St Michaels

Plot Reference: Level 40 Flat 40 04

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.89 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.15 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	37.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	31.8 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	(no roof)		
Openings	0.90 (max. 2.00)	1.00 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South East	9.68m²
Windows facing: North East	11.79m²
Windows facing: South	1.59m²
Windows facing: North	2.56m²
Windows facing: South	2.56m²
Windows facing: West	16.35m²
Windows facing: North	1.57m²
Ventilation rate:	4.00

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10 Key features

Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 40 Flat 40 04

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	122.24 m²	2.7 m

Living area:	63.24 m² (fraction 0.517)
Front of dwelling faces:	East

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
SE	16mm or more	0.8	0.4	1	9.68	1
NE	16mm or more	0.8	0.4	1	11.79	1
S	16mm or more	1	0.4	1	1.59	1
N GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
S GLAZED DOOR	16mm or more	0.7	0.4	1	2.56	1
W	16mm or more	1	0.4	1	16.35	1
N	16mm or more	1	0.4	1	1.57	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE		OPAQUE CURT WALL	South East	0	0
NE		OPAQUE CURT WALL	North East	0	0
S		OPAQUE CURT WALL	South	0	0
N GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S GLAZED DOOR		OPAQUE CURT WALL	South	0	0
W		OPAQUE CURT WALL	West	0	0
N		OPAQUE CURT WALL	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements							
OPAQUE CURT WALL	52.72	46.1	6.62	0.24	0	True	N/A
Internal Elements							
INTERNAL WALLS	185.49						N/A
Party Elements							
PARTY WALLS	37.36						N/A
WALLS TO CORRIDOR	45.2						N/A
PARTY CEILING	122.24						N/A
PARTY FLOOR	122.24						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0748

	Length	Psi-value		
[Approved]	25.55	0.05	E4	Jamb
[Approved]	30.48	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	10.35	0.02	E9	Balcony between dwellings, wall insulation continuous
[Approved]	5.4	0.06	E18	Party wall between dwellings
	61.15	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 5

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Main heating system:

Main heating system: Heat pumps with warm air distribution
Electric heat pumps
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 524
Air source heat pump
Fan coil units

Main heating Control:

Main heating Control: Time and temperature zone control
Control code: 2506

Secondary heating system:

Secondary heating system: None

Space cooling system:

Space cooling system: Split/multiple systems
Tested data to EN 14511:
Brand/Model: PURY-P350 YNW-A
EER: 4.4
Compressor control: Systems with variable speed compressors
Cooled area: 106.48 (fraction 0.871)

Water heating:

Water heating: Electric immersion (on-peak or off-peak)
Water code: 903

SAP Input

Fuel :Electricity
Hot water cylinder
Cylinder volume: 190 litres
Cylinder insulation: Measured loss, 1.61kWh/day
Primary pipework insulation: False
Cylinderstat: True
Cylinder in heated space: True
Immersion: Dual
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24	(1a) x	2.7	(2a) =	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.19 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35

(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			9.68	x 1/[1/(1)+ 0.04]		=	9.31			(27)
Windows Type 2			11.79	x 1/[1/(1)+ 0.04]		=	11.34			(27)
Windows Type 3			1.59	x 1/[1/(1)+ 0.04]		=	1.53			(27)
Windows Type 4			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 5			2.56	x 1/[1/(1)+ 0.04]		=	2.46			(27)
Windows Type 6			16.35	x 1/[1/(1)+ 0.04]		=	15.72			(27)
Windows Type 7			1.57	x 1/[1/(1)+ 0.04]		=	1.51			(27)
Walls	52.72	46.1	6.62	x	0.24	=	1.59			(29)
Total area of elements, m²			52.72							(31)
Party wall			37.36	x	0	=	0			(32)
Party wall			45.2	x	0	=	0			(32)
Party floor			122.24							(32a)
Party ceiling			122.24							(32b)
Internal wall **			185.49							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25416.49 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 3.94 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 49.86 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.7	39.18	38.65	36.01	35.48	32.84	32.84	32.32	33.9	35.48	36.54	37.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.56	89.03	88.51	85.87	85.34	82.7	82.7	82.18	83.76	85.34	86.4	87.45	

Average = Sum(39)$_{1...12}$ /12= | 85.74 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.73	0.73	0.72	0.7	0.7	0.68	0.68	0.67	0.69	0.7	0.71	0.72	

Average = Sum(40)$_{1...12}$ /12= | 0.7 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.87 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 102.4 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = | 1228.8 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = | 1611.15 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 190 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 1.61 | (48)

Temperature factor from Table 2b | 0.6 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.97 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Output from water heater (annual)$_{1...12}$ — 1963.74 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.5	70.22	74.08	66.89	65.89	59.37	57.49	62.43	62.12	69.33	72.72	77.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	172.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	64.21	57.03	46.38	35.11	26.25	22.16	23.94	31.12	41.77	53.04	61.91	66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	430	434.46	423.22	399.28	369.06	340.67	321.69	317.23	328.47	352.41	382.63	411.03	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	55.1	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	106.85	104.49	99.57	92.9	88.56	82.46	77.27	83.92	86.28	93.19	100.99	104.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	713.6	708.52	681.71	639.83	596.41	557.81	535.44	544.8	569.06	611.18	658.06	694.05	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North 0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North 0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North 0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North 0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North 0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North 0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North 0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North 0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North 0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North 0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North 0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North 0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North 0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North 0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North 0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North 0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North 0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North 0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North 0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North 0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North 0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North 0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
North 0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
Northeast 0.9x	0.77	x	11.79	x	11.28	x	0.4	x	0.8	=	29.5	(75)
Northeast 0.9x	0.77	x	11.79	x	22.97	x	0.4	x	0.8	=	60.05	(75)
Northeast 0.9x	0.77	x	11.79	x	41.38	x	0.4	x	0.8	=	108.19	(75)
Northeast 0.9x	0.77	x	11.79	x	67.96	x	0.4	x	0.8	=	177.67	(75)
Northeast 0.9x	0.77	x	11.79	x	91.35	x	0.4	x	0.8	=	238.83	(75)
Northeast 0.9x	0.77	x	11.79	x	97.38	x	0.4	x	0.8	=	254.62	(75)
Northeast 0.9x	0.77	x	11.79	x	91.1	x	0.4	x	0.8	=	238.19	(75)
Northeast 0.9x	0.77	x	11.79	x	72.63	x	0.4	x	0.8	=	189.89	(75)
Northeast 0.9x	0.77	x	11.79	x	50.42	x	0.4	x	0.8	=	131.83	(75)
Northeast 0.9x	0.77	x	11.79	x	28.07	x	0.4	x	0.8	=	73.38	(75)
Northeast 0.9x	0.77	x	11.79	x	14.2	x	0.4	x	0.8	=	37.12	(75)
Northeast 0.9x	0.77	x	11.79	x	9.21	x	0.4	x	0.8	=	24.09	(75)
Southeast 0.9x	0.77	x	9.68	x	36.79	x	0.4	x	0.8	=	78.98	(77)
Southeast 0.9x	0.77	x	9.68	x	62.67	x	0.4	x	0.8	=	134.54	(77)
Southeast 0.9x	0.77	x	9.68	x	85.75	x	0.4	x	0.8	=	184.08	(77)

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Southeast	0.9x	0.77	x	9.68	x	106.25	x	0.4	x	0.8	=	228.08	(77)
Southeast	0.9x	0.77	x	9.68	x	119.01	x	0.4	x	0.8	=	255.47	(77)
Southeast	0.9x	0.77	x	9.68	x	118.15	x	0.4	x	0.8	=	253.63	(77)
Southeast	0.9x	0.77	x	9.68	x	113.91	x	0.4	x	0.8	=	244.52	(77)
Southeast	0.9x	0.77	x	9.68	x	104.39	x	0.4	x	0.8	=	224.09	(77)
Southeast	0.9x	0.77	x	9.68	x	92.85	x	0.4	x	0.8	=	199.32	(77)
Southeast	0.9x	0.77	x	9.68	x	69.27	x	0.4	x	0.8	=	148.69	(77)
Southeast	0.9x	0.77	x	9.68	x	44.07	x	0.4	x	0.8	=	94.6	(77)
Southeast	0.9x	0.77	x	9.68	x	31.49	x	0.4	x	0.8	=	67.59	(77)
South	0.9x	0.77	x	1.59	x	46.75	x	0.4	x	1	=	20.61	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.59	x	76.57	x	0.4	x	1	=	33.75	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.59	x	97.53	x	0.4	x	1	=	42.99	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.59	x	110.23	x	0.4	x	1	=	48.59	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.59	x	114.87	x	0.4	x	1	=	50.63	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.59	x	110.55	x	0.4	x	1	=	48.72	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.59	x	108.01	x	0.4	x	1	=	47.61	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.59	x	104.89	x	0.4	x	1	=	46.23	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.59	x	101.89	x	0.4	x	1	=	44.91	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.59	x	82.59	x	0.4	x	1	=	36.4	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.59	x	55.42	x	0.4	x	1	=	24.42	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.59	x	40.4	x	0.4	x	1	=	17.81	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	16.35	x	19.64	x	0.4	x	1	=	89.01	(80)
West	0.9x	0.77	x	16.35	x	38.42	x	0.4	x	1	=	174.13	(80)
West	0.9x	0.77	x	16.35	x	63.27	x	0.4	x	1	=	286.77	(80)
West	0.9x	0.77	x	16.35	x	92.28	x	0.4	x	1	=	418.23	(80)
West	0.9x	0.77	x	16.35	x	113.09	x	0.4	x	1	=	512.56	(80)
West	0.9x	0.77	x	16.35	x	115.77	x	0.4	x	1	=	524.7	(80)
West	0.9x	0.77	x	16.35	x	110.22	x	0.4	x	1	=	499.53	(80)
West	0.9x	0.77	x	16.35	x	94.68	x	0.4	x	1	=	429.09	(80)

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West	0.9x	0.77	x	16.35	x	73.59	x	0.4	x	1	=	333.52	(80)
West	0.9x	0.77	x	16.35	x	45.59	x	0.4	x	1	=	206.62	(80)
West	0.9x	0.77	x	16.35	x	24.49	x	0.4	x	1	=	110.99	(80)
West	0.9x	0.77	x	16.35	x	16.15	x	0.4	x	1	=	73.2	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	251.24	459.43	702.65	979.02	1184.18	1211.12	1153.1	996.62	798.88	528.66	306.89	211.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	964.83	1167.95	1384.36	1618.85	1780.59	1768.93	1688.54	1541.42	1367.94	1139.84	964.95	905.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.85	0.75	0.59	0.43	0.3	0.21	0.24	0.41	0.68	0.86	0.92	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.25	20.58	20.85	20.96	20.99	21	21	20.98	20.8	20.36	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.32	20.32	20.34	20.34	20.36	20.36	20.37	20.35	20.34	20.33	20.33	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.9	0.84	0.73	0.56	0.4	0.27	0.18	0.21	0.38	0.65	0.84	0.92	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.33	19.79	20.16	20.3	20.35	20.36	20.36	20.33	20.11	19.5	18.86	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.81	20.2	20.52	20.64	20.68	20.69	20.69	20.66	20.47	19.95	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.89	0.83	0.73	0.57	0.42	0.28	0.2	0.23	0.39	0.65	0.83	0.9	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	858.27	965.6	1005.23	924.06	742.83	499.95	337.63	351.58	538.38	745.71	805.49	817.39	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1356.33	1327.07	1212.24	997.74	762.95	503.24	338.29	352.65	549.79	842.04	1109.9	1329.71	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1507.51 (98)

Space heating requirement in kWh/m²/year 12.33 (99)

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8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	777.41	612	624.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	762.73	605.78	615.42	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1973.41	1883.21	1709.68	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	871.69	950.41	814.13	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 2636.23 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.87 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	189.83	206.97	177.29	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ = 574.09 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.7 (108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 170 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Cooling System Energy Efficiency Ratio 5.94 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	370.56	242.9	154.01	53.05	14.97	0	0	0	0	71.67	219.17	381.17	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	217.97	142.88	90.6	31.21	8.81	0	0	0	0	42.16	128.93	224.22	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$ = 886.77 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$ = 0 (215)

Water heating

Output from water heater (calculated above)

	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72

Efficiency of water heater 100 (216)

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(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.99	173.14	180.7	160.41	156.06	137.81	130.79	145.67	146.08	166.42	177.95	191.72	

Total = Sum(219a)$_{1...12}$ = 1963.74 (219)

Space cooling fuel, kWh/month.
(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	31.96	34.84	29.85	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 96.65 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		886.77	
Water heating fuel used		1963.74	
Space cooling fuel used		96.65	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	372.46		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		372.46	(231)
Electricity for lighting		453.6	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3773.21	(338)

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10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	13.19	x 0.01 =	116.96	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)			1			(243)
Low-rate fraction	1.0 – (243) =		0			(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	259.02	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	12.75	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	49.13	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.83	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost (245)...(247) + (250)…(254) =					497.69	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)

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Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.25	(257)
SAP rating (Section 12)		82.56	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	460.23	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1019.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1479.41	(265)
Space cooling	(221) x		0.519	=	50.16	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	193.31	(267)
Electricity for lighting	(232) x		0.519	=	235.42	(268)
Total CO2, kg/year		sum of (265)…(271) =			1958.3	(272)
CO2 emissions per m²		(272) ÷ (4) =			16.02	(273)
EI rating (section 14)					84	(274)

13a. Primary Energy

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	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	2722.38	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		3.07	=	6028.67	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8751.06	(265)
Space cooling	(221) x		3.07	=	296.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	1143.45	(267)
Electricity for lighting	(232) x		0	=	1392.54	(268)
'Total Primary Energy		sum of (265)…(271) =			11583.75	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			94.76	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 40 Flat 40 04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.24	(1a) x	2.7	(2a) =	330.05	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		330.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.42	x1/[1/(1.5)+ 0.04] =	9.08			(27)
Windows Type 2			7.82	x1/[1/(1.5)+ 0.04] =	11.07			(27)
Windows Type 3			1.05	x1/[1/(1.5)+ 0.04] =	1.49			(27)
Windows Type 4			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 5			1.7	x1/[1/(1.5)+ 0.04] =	2.41			(27)
Windows Type 6			10.84	x1/[1/(1.5)+ 0.04] =	15.34			(27)
Windows Type 7			1.04	x1/[1/(1.5)+ 0.04] =	1.47			(27)
Walls	52.72	30.57	22.15	x 0.18 =	3.99			(29)
Total area of elements, m²			52.72					(31)
Party wall			37.36	x 0 =	0			(32)
Party wall			45.2	x 0 =	0			(32)
Party floor			122.24					(32a)
Party ceiling			122.24					(32b)
Internal wall **			185.49					(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 25633.91 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 3.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	61.78	61.5	61.22	59.91	59.67	58.53	58.53	58.31	58.96	59.67	60.16	60.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.77	112.48	112.2	110.89	110.65	109.51	109.51	109.3	109.95	110.65	111.14	111.66	

Average = Sum(39)$_{1...12}$ /12= 110.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.91	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.87 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 102.4 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.64	108.54	104.45	100.35	96.26	92.16	92.16	96.26	100.35	104.45	108.54	112.64	

Total = Sum(44)$_{1...12}$ = 1228.8 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.04	146.1	150.76	131.43	126.11	108.83	100.84	115.72	117.1	136.47	148.97	161.77	

Total = Sum(45)$_{1...12}$ = 1611.15 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.91	22.61	19.72	18.92	16.32	15.13	17.36	17.57	20.47	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.6 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.87	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Output from water heater (annual)$_{1...12}$ 2200.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	95.61	84.77	90.2	82.48	82.01	74.97	73.6	78.55	77.72	85.45	88.31	93.86	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	143.58	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.68	22.81	18.55	14.05	10.5	8.86	9.58	12.45	16.71	21.22	24.76	26.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	288.1	291.09	283.56	267.52	247.27	228.25	215.53	212.54	220.08	236.12	256.36	275.39	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	-114.86	(71)

Water heating gains (Table 5)

(72)m=	128.51	126.15	121.24	114.56	110.22	104.12	98.93	105.58	107.94	114.85	122.66	126.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	511.37	509.13	492.42	465.2	437.07	410.3	393.12	399.65	413.8	441.26	472.86	497.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North 0.9x	0.77	x	1.7	x	10.63	x	0.63	x	0.7	=	5.52	(74)
North 0.9x	0.77	x	1.04	x	10.63	x	0.63	x	0.7	=	3.38	(74)
North 0.9x	0.77	x	1.7	x	20.32	x	0.63	x	0.7	=	10.56	(74)
North 0.9x	0.77	x	1.04	x	20.32	x	0.63	x	0.7	=	6.46	(74)
North 0.9x	0.77	x	1.7	x	34.53	x	0.63	x	0.7	=	17.94	(74)
North 0.9x	0.77	x	1.04	x	34.53	x	0.63	x	0.7	=	10.98	(74)
North 0.9x	0.77	x	1.7	x	55.46	x	0.63	x	0.7	=	28.82	(74)
North 0.9x	0.77	x	1.04	x	55.46	x	0.63	x	0.7	=	17.63	(74)
North 0.9x	0.77	x	1.7	x	74.72	x	0.63	x	0.7	=	38.82	(74)
North 0.9x	0.77	x	1.04	x	74.72	x	0.63	x	0.7	=	23.75	(74)
North 0.9x	0.77	x	1.7	x	79.99	x	0.63	x	0.7	=	41.56	(74)
North 0.9x	0.77	x	1.04	x	79.99	x	0.63	x	0.7	=	25.42	(74)
North 0.9x	0.77	x	1.7	x	74.68	x	0.63	x	0.7	=	38.8	(74)
North 0.9x	0.77	x	1.04	x	74.68	x	0.63	x	0.7	=	23.74	(74)
North 0.9x	0.77	x	1.7	x	59.25	x	0.63	x	0.7	=	30.78	(74)
North 0.9x	0.77	x	1.04	x	59.25	x	0.63	x	0.7	=	18.83	(74)
North 0.9x	0.77	x	1.7	x	41.52	x	0.63	x	0.7	=	21.57	(74)
North 0.9x	0.77	x	1.04	x	41.52	x	0.63	x	0.7	=	13.2	(74)
North 0.9x	0.77	x	1.7	x	24.19	x	0.63	x	0.7	=	12.57	(74)
North 0.9x	0.77	x	1.04	x	24.19	x	0.63	x	0.7	=	7.69	(74)
North 0.9x	0.77	x	1.7	x	13.12	x	0.63	x	0.7	=	6.82	(74)
North 0.9x	0.77	x	1.04	x	13.12	x	0.63	x	0.7	=	4.17	(74)
North 0.9x	0.77	x	1.7	x	8.86	x	0.63	x	0.7	=	4.61	(74)
North 0.9x	0.77	x	1.04	x	8.86	x	0.63	x	0.7	=	2.82	(74)
Northeast 0.9x	0.77	x	7.82	x	11.28	x	0.63	x	0.7	=	26.97	(75)
Northeast 0.9x	0.77	x	7.82	x	22.97	x	0.63	x	0.7	=	54.89	(75)
Northeast 0.9x	0.77	x	7.82	x	41.38	x	0.63	x	0.7	=	98.89	(75)
Northeast 0.9x	0.77	x	7.82	x	67.96	x	0.63	x	0.7	=	162.41	(75)
Northeast 0.9x	0.77	x	7.82	x	91.35	x	0.63	x	0.7	=	218.31	(75)
Northeast 0.9x	0.77	x	7.82	x	97.38	x	0.63	x	0.7	=	232.74	(75)
Northeast 0.9x	0.77	x	7.82	x	91.1	x	0.63	x	0.7	=	217.72	(75)
Northeast 0.9x	0.77	x	7.82	x	72.63	x	0.63	x	0.7	=	173.57	(75)
Northeast 0.9x	0.77	x	7.82	x	50.42	x	0.63	x	0.7	=	120.5	(75)
Northeast 0.9x	0.77	x	7.82	x	28.07	x	0.63	x	0.7	=	67.08	(75)
Northeast 0.9x	0.77	x	7.82	x	14.2	x	0.63	x	0.7	=	33.93	(75)
Northeast 0.9x	0.77	x	7.82	x	9.21	x	0.63	x	0.7	=	22.02	(75)
Southeast 0.9x	0.77	x	6.42	x	36.79	x	0.63	x	0.7	=	72.19	(77)
Southeast 0.9x	0.77	x	6.42	x	62.67	x	0.63	x	0.7	=	122.97	(77)
Southeast 0.9x	0.77	x	6.42	x	85.75	x	0.63	x	0.7	=	168.25	(77)

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Southeast	0.9x	0.77	x	6.42	x	106.25	x	0.63	x	0.7	=	208.47	(77)
Southeast	0.9x	0.77	x	6.42	x	119.01	x	0.63	x	0.7	=	233.5	(77)
Southeast	0.9x	0.77	x	6.42	x	118.15	x	0.63	x	0.7	=	231.81	(77)
Southeast	0.9x	0.77	x	6.42	x	113.91	x	0.63	x	0.7	=	223.49	(77)
Southeast	0.9x	0.77	x	6.42	x	104.39	x	0.63	x	0.7	=	204.82	(77)
Southeast	0.9x	0.77	x	6.42	x	92.85	x	0.63	x	0.7	=	182.18	(77)
Southeast	0.9x	0.77	x	6.42	x	69.27	x	0.63	x	0.7	=	135.91	(77)
Southeast	0.9x	0.77	x	6.42	x	44.07	x	0.63	x	0.7	=	86.47	(77)
Southeast	0.9x	0.77	x	6.42	x	31.49	x	0.63	x	0.7	=	61.78	(77)
South	0.9x	0.77	x	1.05	x	46.75	x	0.63	x	0.7	=	15	(78)
South	0.9x	0.77	x	1.7	x	46.75	x	0.63	x	0.7	=	24.29	(78)
South	0.9x	0.77	x	1.05	x	76.57	x	0.63	x	0.7	=	24.57	(78)
South	0.9x	0.77	x	1.7	x	76.57	x	0.63	x	0.7	=	39.78	(78)
South	0.9x	0.77	x	1.05	x	97.53	x	0.63	x	0.7	=	31.3	(78)
South	0.9x	0.77	x	1.7	x	97.53	x	0.63	x	0.7	=	50.67	(78)
South	0.9x	0.77	x	1.05	x	110.23	x	0.63	x	0.7	=	35.37	(78)
South	0.9x	0.77	x	1.7	x	110.23	x	0.63	x	0.7	=	57.27	(78)
South	0.9x	0.77	x	1.05	x	114.87	x	0.63	x	0.7	=	36.86	(78)
South	0.9x	0.77	x	1.7	x	114.87	x	0.63	x	0.7	=	59.68	(78)
South	0.9x	0.77	x	1.05	x	110.55	x	0.63	x	0.7	=	35.47	(78)
South	0.9x	0.77	x	1.7	x	110.55	x	0.63	x	0.7	=	57.43	(78)
South	0.9x	0.77	x	1.05	x	108.01	x	0.63	x	0.7	=	34.66	(78)
South	0.9x	0.77	x	1.7	x	108.01	x	0.63	x	0.7	=	56.12	(78)
South	0.9x	0.77	x	1.05	x	104.89	x	0.63	x	0.7	=	33.66	(78)
South	0.9x	0.77	x	1.7	x	104.89	x	0.63	x	0.7	=	54.5	(78)
South	0.9x	0.77	x	1.05	x	101.89	x	0.63	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.7	x	101.89	x	0.63	x	0.7	=	52.93	(78)
South	0.9x	0.77	x	1.05	x	82.59	x	0.63	x	0.7	=	26.5	(78)
South	0.9x	0.77	x	1.7	x	82.59	x	0.63	x	0.7	=	42.91	(78)
South	0.9x	0.77	x	1.05	x	55.42	x	0.63	x	0.7	=	17.78	(78)
South	0.9x	0.77	x	1.7	x	55.42	x	0.63	x	0.7	=	28.79	(78)
South	0.9x	0.77	x	1.05	x	40.4	x	0.63	x	0.7	=	12.96	(78)
South	0.9x	0.77	x	1.7	x	40.4	x	0.63	x	0.7	=	20.99	(78)
West	0.9x	0.77	x	10.84	x	19.64	x	0.63	x	0.7	=	65.07	(80)
West	0.9x	0.77	x	10.84	x	38.42	x	0.63	x	0.7	=	127.28	(80)
West	0.9x	0.77	x	10.84	x	63.27	x	0.63	x	0.7	=	209.61	(80)
West	0.9x	0.77	x	10.84	x	92.28	x	0.63	x	0.7	=	305.71	(80)
West	0.9x	0.77	x	10.84	x	113.09	x	0.63	x	0.7	=	374.66	(80)
West	0.9x	0.77	x	10.84	x	115.77	x	0.63	x	0.7	=	383.53	(80)
West	0.9x	0.77	x	10.84	x	110.22	x	0.63	x	0.7	=	365.14	(80)
West	0.9x	0.77	x	10.84	x	94.68	x	0.63	x	0.7	=	313.65	(80)

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West	0.9x	0.77	x	10.84	x	73.59	x	0.63	x	0.7	=	243.79	(80)
West	0.9x	0.77	x	10.84	x	45.59	x	0.63	x	0.7	=	151.03	(80)
West	0.9x	0.77	x	10.84	x	24.49	x	0.63	x	0.7	=	81.13	(80)
West	0.9x	0.77	x	10.84	x	16.15	x	0.63	x	0.7	=	53.51	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	212.42	386.5	587.64	815.68	985.58	1007.97	959.66	829.8	666.86	443.68	259.08	178.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	723.79	895.63	1080.06	1280.87	1422.65	1418.27	1352.78	1229.45	1080.66	884.94	731.94	675.7	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.69	0.49	0.36	0.41	0.68	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.26	20.54	20.83	20.96	21	21	21	20.98	20.75	20.34	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.64	0.43	0.29	0.34	0.6	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.9	19.18	19.57	19.97	20.13	20.17	20.17	20.17	20.15	19.88	19.31	18.85	(90)

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.74	20.07	20.41	20.56	20.6	20.6	20.6	20.58	20.33	19.84	19.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.86	0.67	0.46	0.32	0.37	0.64	0.93	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	721.46	885.79	1036.82	1098.75	946.96	653.63	437.7	458.38	692.61	821.73	725.54	674.21	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1714.5	1668.99	1522.63	1276.68	980.68	656.7	437.98	459.03	712.35	1076.43	1416.28	1704.56	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3233.19 (98)

Space heating requirement in kWh/m²/year 26.45 (99)

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TER WorkSheet: New dwelling design stage

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
738.83	526.32	361.45	128.11	25.08	0	0	0	0	189.5	497.33	766.58	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
790.19	562.9	386.57	137.02	26.83	0	0	0	0	202.67	531.91	819.87	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3457.96 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

217.13	191.34	200.85	179.91	176.21	157.3	150.94	165.81	165.58	186.56	197.44	211.86	

Efficiency of water heater 79.8 (216)

(217)m=	87.83	87.38	86.36	83.93	80.99	79.8	79.8	79.8	79.8	84.86	87.18	87.95

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	247.23	218.98	232.56	214.36	217.56	197.12	189.14	207.78	207.49	219.86	226.48	240.9	

Total = Sum(219a)$_{1...12}$ = 2619.48 (219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1		3457.96
Water heating fuel used		2619.48
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		453.6 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6606.04 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	746.92	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	565.81	(264)

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TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1312.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	235.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1587.07	(272)

TER = 18.89 (273)

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SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 40 Flat 40 04

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	435.66	**(P1)**
Transmission heat loss coefficient:	49.9	
Summer heat loss coefficient:	485.52	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
North East (NE)	0	1
South (S)	0	1
North (N GLAZED DOOR)	0	1
South (S GLAZED DOOR)	0	1
West (W)	0	1
North (N)	0	1

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Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	**(P8)**
North East (NE)	1	0.9	1	0.9	**(P8)**
South (S)	1	0.9	1	0.9	**(P8)**
North (N GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
West (W)	1	0.9	1	0.9	**(P8)**
North (N)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
South East (SE)	0.9 x	9.68	112.1	0.4	0.8	0.9	281.27	
North East (NE)	0.9 x	11.79	89.66	0.4	0.8	0.9	273.98	
South (S)	0.9 x	1.59	106.3	0.4	1	0.9	54.76	
North (N GLAZED DOOR)	0.9 x	2.56	73.49	0.4	0.7	0.9	42.67	
South (S GLAZED DOOR)	0.9 x	2.56	106.3	0.4	0.7	0.9	61.72	
West (W)	0.9 x	16.35	108.47	0.4	1	0.9	574.6	
North (N)	0.9 x	1.57	73.49	0.4	1	0.9	37.38	
						Total	1326.38	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	557.81	535.44	544.8	
Total summer gains	1994.64	1861.82	1672.58	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	4.11	3.83	3.44	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.11	21.53	21.04	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

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Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.54
Printed on 26 August 2022 at 13:12:56

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 774.83m²

Site Reference : P1785 St Michaels

Plot Reference: Level 41

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	21.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.72 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	67.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	57.5 kWh/m²	
		OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.00 (max. 0.30)	0.00 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	**OK**
Openings	0.75 (max. 2.00)	1.10 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Heat pumps with warm air distribution - electric
Air source heat pump
Efficiency 170 %
Minimum 170 %

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG: 2.17 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	No primary pipework	

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.74	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (West Pennines):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South	24.27m²
Windows facing: North	6.39m²
Windows facing: South	6.39m²
Windows facing: North East	47.6m²
Windows facing: North	24.27m²
Windows facing: North West	47.6m²
Windows facing: North East	22.12m²
Windows facing: South East	22.11m²
Windows facing: South West	22.11m²
Windows facing: North West	22.01m²
Windows facing: North	9.2m²
Windows facing: South	9.2m²
Windows facing: South East	47.6m²
Windows facing: South West	47.6m²
Roof windows facing: Horizontal	101.02m²
Ventilation rate:	4.00

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10 Key features

Thermal bridging	0.016 W/m²K
Windows U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Fixed cooling system	

SAP Input

Property Details: Level 41

Address:	
Located in:	England
Region:	West Pennines
UPRN:	
Date of assessment:	11 August 2022
Date of certificate:	26 August 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	486

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2022

Floor Location:	Floor area:	Storey height:
Floor 0	774.83 m²	3.61 m

Living area:	370.8 m² (fraction 0.479)
Front of dwelling faces:	West

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Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
S 41	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N 41 GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S 41 GLAZED DOOR	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE 41	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N 41	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NW 41	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NE MEZ	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SE MEZ	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SW MEZ	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
NW MEZ	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
N MEZ	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
S MEZ	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SE 41	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
SW 41	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
ROOF LIGHT	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
S 41	16mm or more	1	0.4	1	24.27	1
N 41 GLAZED DOOR	16mm or more	0.7	0.4	1	6.39	1
S 41 GLAZED DOOR	16mm or more	0.7	0.4	1	6.39	1
NE 41	16mm or more	0.8	0.4	1	47.6	1
N 41	16mm or more	1	0.4	1	24.27	1
NW 41	16mm or more	0.8	0.4	1	47.6	1
NE MEZ	16mm or more	1	0.4	1	22.12	1
SE MEZ	16mm or more	1	0.4	1	22.11	1
SW MEZ	16mm or more	1	0.4	1	22.11	1
NW MEZ	16mm or more	1	0.4	1	22.01	1
N MEZ	16mm or more	1	0.4	1	9.2	1
S MEZ	16mm or more	1	0.4	1	9.2	1

SAP Input

SE 41	16mm or more	0.8	0.4	1	47.6	1
SW 41	16mm or more	0.8	0.4	1	47.6	1
ROOF LIGHT	16mm or more	1	0.4	1.1	101.02	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
S 41		OPAQUE CURT WALL	South	0	0
N 41 GLAZED DOOR		OPAQUE CURT WALL	North	0	0
S 41 GLAZED DOOR		OPAQUE CURT WALL	South	0	0
NE 41		OPAQUE CURT WALL	North East	0	0
N 41		OPAQUE CURT WALL	North	0	0
NW 41		OPAQUE CURT WALL	North West	0	0
NE MEZ		OPAQUE CURT WALL	North East	0	0
SE MEZ		OPAQUE CURT WALL	South East	0	0
SW MEZ		OPAQUE CURT WALL	South West	0	0
NW MEZ		OPAQUE CURT WALL	North West	0	0
N MEZ		OPAQUE CURT WALL	North	0	0
S MEZ		OPAQUE CURT WALL	South	0	0
SE 41		OPAQUE CURT WALL	South East	0	0
SW 41		OPAQUE CURT WALL	South West	0	0
ROOF LIGHT		EXTERNAL ROOF	Horizontal	0.001	0

Overshading: Average or unknown

Opaque Elements:

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Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
OPAQUE CURT WALL	571.04	358.47	212.57	0.24	0	True	N/A
Mez Opaque Strip	35.91	0	35.91	0.3	0	True	N/A
EXTERNAL ROOF	774.83	101.02	673.81	0.15	0		N/A
Internal Elements							
INT WALLS	1022.76						N/A
Party Elements							
WALLS TO CORRIDOR	165.51						N/A
PARTY FLOOR	774.83						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.016

	Length	Psi-value		
[Approved]	204	0.05	E4	Jamb
[Approved]	92.43	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	24	0.02	E9	Balcony between dwellings, wall insulation continuous
	61.3	0	E6	Intermediate floor within a dwelling
	61.3	0.08	E14	Flat roof
	122.66	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 0
Pressure test: 5

SAP Input

Main heating system:

Main heating system:	Heat pumps with warm air distribution Electric heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 524 Air source heat pump Fan coil units

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2506

Secondary heating system:

Secondary heating system:	None

Space cooling system:

Space cooling system:	Split/multiple systems Tested data to EN 14511: Brand/Model: PURY-P550 YNW-A EER: 2.84 Compressor control: Systems with variable speed compressors Cooled area: 683.15 (fraction 0.882)

Water heating:

Water heating:	Electric immersion (on-peak or off-peak) Water code: 903 Fuel :Electricity Hot water cylinder Cylinder volume: 190 litres Cylinder insulation: Measured loss, 1.61kWh/day Primary pipework insulation: False Cylinderstat: True Cylinder in heated space: True Immersion: Dual Solar panel: False

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Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 41

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	774.83	(1a) x	3.61	(2a) =	2797.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	774.83	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		2797.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.25 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.25 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.32	0.31	0.31	0.28	0.27	0.24	0.24	0.23	0.25	0.27	0.28	0.29

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.44	0.43	0.42	0.39	0.39	0.36	0.36	0.35	0.37	0.39	0.4	0.41	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.44	0.43	0.42	0.39	0.39	0.36	0.36	0.35	0.37	0.39	0.4	0.41	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			24.27	x 1/[1/(1)+ 0.04]		=	23.34			(27)
Windows Type 2			6.39	x 1/[1/(1)+ 0.04]		=	6.14			(27)
Windows Type 3			6.39	x 1/[1/(1)+ 0.04]		=	6.14			(27)
Windows Type 4			47.6	x 1/[1/(1)+ 0.04]		=	45.77			(27)
Windows Type 5			24.27	x 1/[1/(1)+ 0.04]		=	23.34			(27)
Windows Type 6			47.6	x 1/[1/(1)+ 0.04]		=	45.77			(27)
Windows Type 7			22.12	x 1/[1/(1)+ 0.04]		=	21.27			(27)
Windows Type 8			22.11	x 1/[1/(1)+ 0.04]		=	21.26			(27)
Windows Type 9			22.11	x 1/[1/(1)+ 0.04]		=	21.26			(27)
Windows Type 10			22.01	x 1/[1/(1)+ 0.04]		=	21.16			(27)
Windows Type 11			9.2	x 1/[1/(1)+ 0.04]		=	8.85			(27)
Windows Type 12			9.2	x 1/[1/(1)+ 0.04]		=	8.85			(27)
Windows Type 13			47.6	x 1/[1/(1)+ 0.04]		=	45.77			(27)
Windows Type 14			47.6	x 1/[1/(1)+ 0.04]		=	45.77			(27)
Rooflights			101.02	x1/[1/(1.1) + 0.04]		=	111.122			(27b)
Walls Type1	571.04	358.47	212.57	x	0.24	=	51.02			(29)
Walls Type2	35.91	0	35.91	x	0.3	=	10.77			(29)
Roof	774.83	101.02	673.81	x	0.15	=	101.07			(30)
Total area of elements, m²			1381.78							(31)

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Party wall	165.51	x	0	=	0		(32)
Party floor	774.83						(32a)
Internal wall **	1022.76						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 613.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 84044.45 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 22.05 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 636.04 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	402.68	396.91	391.14	362.3	356.53	327.68	327.68	321.92	339.22	356.53	368.07	379.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	1038.72	1032.95	1027.18	998.34	992.57	963.72	963.72	957.95	975.26	992.57	1004.1	1015.64	

Average = Sum(39)$_{1...12}$ /12= 996.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.34	1.33	1.33	1.29	1.28	1.24	1.24	1.24	1.26	1.28	1.3	1.31	

Average = Sum(40)$_{1...12}$ /12= 1.29 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.75 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 123.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	135.57	130.64	125.71	120.78	115.85	110.92	110.92	115.85	120.78	125.71	130.64	135.57	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1478.92 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	201.04	175.83	181.44	158.19	151.79	130.98	121.37	139.28	140.94	164.25	179.29	194.7	

Total = Sum(45)$_{1...12}$ = 1939.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	30.16	26.38	27.22	23.73	22.77	19.65	18.21	20.89	21.14	24.64	26.89	29.2	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

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Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.61	(48)
Temperature factor from Table 2b		0.6	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.97	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.97	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	230.99	202.88	211.39	187.17	181.73	159.96	151.32	169.22	169.92	194.2	208.27	224.65	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	230.99	202.88	211.39	187.17	181.73	159.96	151.32	169.22	169.92	194.2	208.27	224.65	

Output from water heater (annual)$_{1...12}$: 2291.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.8	80.1	84.29	75.78	74.43	66.73	64.31	70.27	70.05	78.57	82.8	88.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	224.95	224.95	224.95	224.95	224.95	224.95	224.95	224.95	224.95	224.95	224.95	224.95	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	173.89	154.45	125.6	95.09	71.08	60.01	64.84	84.28	113.13	143.64	167.65	178.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	1164.47	1176.55	1146.1	1081.28	999.45	922.54	871.16	859.08	889.53	954.35	1036.18	1113.09	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	61.24	61.24	61.24	61.24	61.24	61.24	61.24	61.24	61.24	61.24	61.24	61.24	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	(71)

Water heating gains (Table 5)

(72)m=	122.05	119.2	113.29	105.25	100.03	92.69	86.44	94.44	97.29	105.61	115	119.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	1596.63	1586.43	1521.22	1417.85	1306.79	1211.46	1158.67	1174.03	1236.17	1339.82	1455.06	1547.25	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.39	x	10.63	x	0.4	x	0.7	=	13.18	(74)
North	0.9x 0.77	x	24.27	x	10.63	x	0.4	x	1	=	71.54	(74)
North	0.9x 0.77	x	9.2	x	10.63	x	0.4	x	1	=	27.12	(74)
North	0.9x 0.77	x	6.39	x	20.32	x	0.4	x	0.7	=	25.2	(74)
North	0.9x 0.77	x	24.27	x	20.32	x	0.4	x	1	=	136.71	(74)
North	0.9x 0.77	x	9.2	x	20.32	x	0.4	x	1	=	51.82	(74)
North	0.9x 0.77	x	6.39	x	34.53	x	0.4	x	0.7	=	42.81	(74)
North	0.9x 0.77	x	24.27	x	34.53	x	0.4	x	1	=	232.31	(74)
North	0.9x 0.77	x	9.2	x	34.53	x	0.4	x	1	=	88.06	(74)
North	0.9x 0.77	x	6.39	x	55.46	x	0.4	x	0.7	=	68.77	(74)
North	0.9x 0.77	x	24.27	x	55.46	x	0.4	x	1	=	373.15	(74)
North	0.9x 0.77	x	9.2	x	55.46	x	0.4	x	1	=	141.45	(74)
North	0.9x 0.77	x	6.39	x	74.72	x	0.4	x	0.7	=	92.64	(74)
North	0.9x 0.77	x	24.27	x	74.72	x	0.4	x	1	=	502.66	(74)
North	0.9x 0.77	x	9.2	x	74.72	x	0.4	x	1	=	190.54	(74)
North	0.9x 0.77	x	6.39	x	79.99	x	0.4	x	0.7	=	99.18	(74)
North	0.9x 0.77	x	24.27	x	79.99	x	0.4	x	1	=	538.11	(74)
North	0.9x 0.77	x	9.2	x	79.99	x	0.4	x	1	=	203.98	(74)
North	0.9x 0.77	x	6.39	x	74.68	x	0.4	x	0.7	=	92.59	(74)
North	0.9x 0.77	x	24.27	x	74.68	x	0.4	x	1	=	502.4	(74)
North	0.9x 0.77	x	9.2	x	74.68	x	0.4	x	1	=	190.44	(74)
North	0.9x 0.77	x	6.39	x	59.25	x	0.4	x	0.7	=	73.46	(74)
North	0.9x 0.77	x	24.27	x	59.25	x	0.4	x	1	=	398.59	(74)
North	0.9x 0.77	x	9.2	x	59.25	x	0.4	x	1	=	151.09	(74)
North	0.9x 0.77	x	6.39	x	41.52	x	0.4	x	0.7	=	51.48	(74)
North	0.9x 0.77	x	24.27	x	41.52	x	0.4	x	1	=	279.31	(74)
North	0.9x 0.77	x	9.2	x	41.52	x	0.4	x	1	=	105.88	(74)
North	0.9x 0.77	x	6.39	x	24.19	x	0.4	x	0.7	=	29.99	(74)
North	0.9x 0.77	x	24.27	x	24.19	x	0.4	x	1	=	162.74	(74)
North	0.9x 0.77	x	9.2	x	24.19	x	0.4	x	1	=	61.69	(74)

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North	0.9x	0.77	x	6.39	x	13.12	x	0.4	x	0.7	=	16.26	(74)
North	0.9x	0.77	x	24.27	x	13.12	x	0.4	x	1	=	88.25	(74)
North	0.9x	0.77	x	9.2	x	13.12	x	0.4	x	1	=	33.45	(74)
North	0.9x	0.77	x	6.39	x	8.86	x	0.4	x	0.7	=	10.99	(74)
North	0.9x	0.77	x	24.27	x	8.86	x	0.4	x	1	=	59.64	(74)
North	0.9x	0.77	x	9.2	x	8.86	x	0.4	x	1	=	22.61	(74)
Northeast	0.9x	0.77	x	47.6	x	11.28	x	0.4	x	0.8	=	119.1	(75)
Northeast	0.9x	0.77	x	22.12	x	11.28	x	0.4	x	1	=	69.18	(75)
Northeast	0.9x	0.77	x	47.6	x	22.97	x	0.4	x	0.8	=	242.43	(75)
Northeast	0.9x	0.77	x	22.12	x	22.97	x	0.4	x	1	=	140.82	(75)
Northeast	0.9x	0.77	x	47.6	x	41.38	x	0.4	x	0.8	=	436.79	(75)
Northeast	0.9x	0.77	x	22.12	x	41.38	x	0.4	x	1	=	253.72	(75)
Northeast	0.9x	0.77	x	47.6	x	67.96	x	0.4	x	0.8	=	717.33	(75)
Northeast	0.9x	0.77	x	22.12	x	67.96	x	0.4	x	1	=	416.68	(75)
Northeast	0.9x	0.77	x	47.6	x	91.35	x	0.4	x	0.8	=	964.23	(75)
Northeast	0.9x	0.77	x	22.12	x	91.35	x	0.4	x	1	=	560.1	(75)
Northeast	0.9x	0.77	x	47.6	x	97.38	x	0.4	x	0.8	=	1027.97	(75)
Northeast	0.9x	0.77	x	22.12	x	97.38	x	0.4	x	1	=	597.13	(75)
Northeast	0.9x	0.77	x	47.6	x	91.1	x	0.4	x	0.8	=	961.64	(75)
Northeast	0.9x	0.77	x	22.12	x	91.1	x	0.4	x	1	=	558.6	(75)
Northeast	0.9x	0.77	x	47.6	x	72.63	x	0.4	x	0.8	=	766.63	(75)
Northeast	0.9x	0.77	x	22.12	x	72.63	x	0.4	x	1	=	445.32	(75)
Northeast	0.9x	0.77	x	47.6	x	50.42	x	0.4	x	0.8	=	532.23	(75)
Northeast	0.9x	0.77	x	22.12	x	50.42	x	0.4	x	1	=	309.16	(75)
Northeast	0.9x	0.77	x	47.6	x	28.07	x	0.4	x	0.8	=	296.27	(75)
Northeast	0.9x	0.77	x	22.12	x	28.07	x	0.4	x	1	=	172.1	(75)
Northeast	0.9x	0.77	x	47.6	x	14.2	x	0.4	x	0.8	=	149.86	(75)
Northeast	0.9x	0.77	x	22.12	x	14.2	x	0.4	x	1	=	87.05	(75)
Northeast	0.9x	0.77	x	47.6	x	9.21	x	0.4	x	0.8	=	97.26	(75)
Northeast	0.9x	0.77	x	22.12	x	9.21	x	0.4	x	1	=	56.5	(75)
Southeast	0.9x	0.77	x	22.11	x	36.79	x	0.4	x	1	=	225.51	(77)
Southeast	0.9x	0.77	x	47.6	x	36.79	x	0.4	x	0.8	=	388.39	(77)
Southeast	0.9x	0.77	x	22.11	x	62.67	x	0.4	x	1	=	384.12	(77)
Southeast	0.9x	0.77	x	47.6	x	62.67	x	0.4	x	0.8	=	661.57	(77)
Southeast	0.9x	0.77	x	22.11	x	85.75	x	0.4	x	1	=	525.57	(77)
Southeast	0.9x	0.77	x	47.6	x	85.75	x	0.4	x	0.8	=	905.19	(77)
Southeast	0.9x	0.77	x	22.11	x	106.25	x	0.4	x	1	=	651.2	(77)
Southeast	0.9x	0.77	x	47.6	x	106.25	x	0.4	x	0.8	=	1121.57	(77)
Southeast	0.9x	0.77	x	22.11	x	119.01	x	0.4	x	1	=	729.4	(77)
Southeast	0.9x	0.77	x	47.6	x	119.01	x	0.4	x	0.8	=	1256.25	(77)
Southeast	0.9x	0.77	x	22.11	x	118.15	x	0.4	x	1	=	724.13	(77)

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Southeast	0.9x	0.77	x	47.6	x	118.15	x	0.4	x	0.8	=	1247.17	(77)
Southeast	0.9x	0.77	x	22.11	x	113.91	x	0.4	x	1	=	698.14	(77)
Southeast	0.9x	0.77	x	47.6	x	113.91	x	0.4	x	0.8	=	1202.4	(77)
Southeast	0.9x	0.77	x	22.11	x	104.39	x	0.4	x	1	=	639.8	(77)
Southeast	0.9x	0.77	x	47.6	x	104.39	x	0.4	x	0.8	=	1101.92	(77)
Southeast	0.9x	0.77	x	22.11	x	92.85	x	0.4	x	1	=	569.08	(77)
Southeast	0.9x	0.77	x	47.6	x	92.85	x	0.4	x	0.8	=	980.12	(77)
Southeast	0.9x	0.77	x	22.11	x	69.27	x	0.4	x	1	=	424.53	(77)
Southeast	0.9x	0.77	x	47.6	x	69.27	x	0.4	x	0.8	=	731.17	(77)
Southeast	0.9x	0.77	x	22.11	x	44.07	x	0.4	x	1	=	270.1	(77)
Southeast	0.9x	0.77	x	47.6	x	44.07	x	0.4	x	0.8	=	465.2	(77)
Southeast	0.9x	0.77	x	22.11	x	31.49	x	0.4	x	1	=	192.99	(77)
Southeast	0.9x	0.77	x	47.6	x	31.49	x	0.4	x	0.8	=	332.38	(77)
South	0.9x	0.77	x	24.27	x	46.75	x	0.4	x	1	=	314.53	(78)
South	0.9x	0.77	x	6.39	x	46.75	x	0.4	x	0.7	=	57.97	(78)
South	0.9x	0.77	x	9.2	x	46.75	x	0.4	x	1	=	119.23	(78)
South	0.9x	0.77	x	24.27	x	76.57	x	0.4	x	1	=	515.12	(78)
South	0.9x	0.77	x	6.39	x	76.57	x	0.4	x	0.7	=	94.94	(78)
South	0.9x	0.77	x	9.2	x	76.57	x	0.4	x	1	=	195.27	(78)
South	0.9x	0.77	x	24.27	x	97.53	x	0.4	x	1	=	656.17	(78)
South	0.9x	0.77	x	6.39	x	97.53	x	0.4	x	0.7	=	120.93	(78)
South	0.9x	0.77	x	9.2	x	97.53	x	0.4	x	1	=	248.73	(78)
South	0.9x	0.77	x	24.27	x	110.23	x	0.4	x	1	=	741.62	(78)
South	0.9x	0.77	x	6.39	x	110.23	x	0.4	x	0.7	=	136.68	(78)
South	0.9x	0.77	x	9.2	x	110.23	x	0.4	x	1	=	281.12	(78)
South	0.9x	0.77	x	24.27	x	114.87	x	0.4	x	1	=	772.81	(78)
South	0.9x	0.77	x	6.39	x	114.87	x	0.4	x	0.7	=	142.43	(78)
South	0.9x	0.77	x	9.2	x	114.87	x	0.4	x	1	=	292.95	(78)
South	0.9x	0.77	x	24.27	x	110.55	x	0.4	x	1	=	743.73	(78)
South	0.9x	0.77	x	6.39	x	110.55	x	0.4	x	0.7	=	137.07	(78)
South	0.9x	0.77	x	9.2	x	110.55	x	0.4	x	1	=	281.92	(78)
South	0.9x	0.77	x	24.27	x	108.01	x	0.4	x	1	=	726.67	(78)
South	0.9x	0.77	x	6.39	x	108.01	x	0.4	x	0.7	=	133.93	(78)
South	0.9x	0.77	x	9.2	x	108.01	x	0.4	x	1	=	275.46	(78)
South	0.9x	0.77	x	24.27	x	104.89	x	0.4	x	1	=	705.69	(78)
South	0.9x	0.77	x	6.39	x	104.89	x	0.4	x	0.7	=	130.06	(78)
South	0.9x	0.77	x	9.2	x	104.89	x	0.4	x	1	=	267.51	(78)
South	0.9x	0.77	x	24.27	x	101.89	x	0.4	x	1	=	685.45	(78)
South	0.9x	0.77	x	6.39	x	101.89	x	0.4	x	0.7	=	126.33	(78)
South	0.9x	0.77	x	9.2	x	101.89	x	0.4	x	1	=	259.83	(78)
South	0.9x	0.77	x	24.27	x	82.59	x	0.4	x	1	=	555.61	(78)

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South	0.9x	0.77	x	6.39	x	82.59	x	0.4	x	0.7	=	102.4	(78)
South	0.9x	0.77	x	9.2	x	82.59	x	0.4	x	1	=	210.61	(78)
South	0.9x	0.77	x	24.27	x	55.42	x	0.4	x	1	=	372.83	(78)
South	0.9x	0.77	x	6.39	x	55.42	x	0.4	x	0.7	=	68.71	(78)
South	0.9x	0.77	x	9.2	x	55.42	x	0.4	x	1	=	141.33	(78)
South	0.9x	0.77	x	24.27	x	40.4	x	0.4	x	1	=	271.78	(78)
South	0.9x	0.77	x	6.39	x	40.4	x	0.4	x	0.7	=	50.09	(78)
South	0.9x	0.77	x	9.2	x	40.4	x	0.4	x	1	=	103.02	(78)
Southwest	0.9x	0.77	x	22.11	x	36.79		0.4	x	1	=	225.51	(79)
Southwest	0.9x	0.77	x	47.6	x	36.79		0.4	x	0.8	=	388.39	(79)
Southwest	0.9x	0.77	x	22.11	x	62.67		0.4	x	1	=	384.12	(79)
Southwest	0.9x	0.77	x	47.6	x	62.67		0.4	x	0.8	=	661.57	(79)
Southwest	0.9x	0.77	x	22.11	x	85.75		0.4	x	1	=	525.57	(79)
Southwest	0.9x	0.77	x	47.6	x	85.75		0.4	x	0.8	=	905.19	(79)
Southwest	0.9x	0.77	x	22.11	x	106.25		0.4	x	1	=	651.2	(79)
Southwest	0.9x	0.77	x	47.6	x	106.25		0.4	x	0.8	=	1121.57	(79)
Southwest	0.9x	0.77	x	22.11	x	119.01		0.4	x	1	=	729.4	(79)
Southwest	0.9x	0.77	x	47.6	x	119.01		0.4	x	0.8	=	1256.25	(79)
Southwest	0.9x	0.77	x	22.11	x	118.15		0.4	x	1	=	724.13	(79)
Southwest	0.9x	0.77	x	47.6	x	118.15		0.4	x	0.8	=	1247.17	(79)
Southwest	0.9x	0.77	x	22.11	x	113.91		0.4	x	1	=	698.14	(79)
Southwest	0.9x	0.77	x	47.6	x	113.91		0.4	x	0.8	=	1202.4	(79)
Southwest	0.9x	0.77	x	22.11	x	104.39		0.4	x	1	=	639.8	(79)
Southwest	0.9x	0.77	x	47.6	x	104.39		0.4	x	0.8	=	1101.92	(79)
Southwest	0.9x	0.77	x	22.11	x	92.85		0.4	x	1	=	569.08	(79)
Southwest	0.9x	0.77	x	47.6	x	92.85		0.4	x	0.8	=	980.12	(79)
Southwest	0.9x	0.77	x	22.11	x	69.27		0.4	x	1	=	424.53	(79)
Southwest	0.9x	0.77	x	47.6	x	69.27		0.4	x	0.8	=	731.17	(79)
Southwest	0.9x	0.77	x	22.11	x	44.07		0.4	x	1	=	270.1	(79)
Southwest	0.9x	0.77	x	47.6	x	44.07		0.4	x	0.8	=	465.2	(79)
Southwest	0.9x	0.77	x	22.11	x	31.49		0.4	x	1	=	192.99	(79)
Southwest	0.9x	0.77	x	47.6	x	31.49		0.4	x	0.8	=	332.38	(79)
Northwest	0.9x	0.77	x	47.6	x	11.28	x	0.4	x	0.8	=	119.1	(81)
Northwest	0.9x	0.77	x	22.01	x	11.28	x	0.4	x	1	=	68.84	(81)
Northwest	0.9x	0.77	x	47.6	x	22.97	x	0.4	x	0.8	=	242.43	(81)
Northwest	0.9x	0.77	x	22.01	x	22.97	x	0.4	x	1	=	140.12	(81)
Northwest	0.9x	0.77	x	47.6	x	41.38	x	0.4	x	0.8	=	436.79	(81)
Northwest	0.9x	0.77	x	22.01	x	41.38	x	0.4	x	1	=	252.46	(81)
Northwest	0.9x	0.77	x	47.6	x	67.96	x	0.4	x	0.8	=	717.33	(81)
Northwest	0.9x	0.77	x	22.01	x	67.96	x	0.4	x	1	=	414.61	(81)
Northwest	0.9x	0.77	x	47.6	x	91.35	x	0.4	x	0.8	=	964.23	(81)

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Northwest 0.9x	0.77	x	22.01	x	91.35	x	0.4	x	1	=	557.32	(81)
Northwest 0.9x	0.77	x	47.6	x	97.38	x	0.4	x	0.8	=	1027.97	(81)
Northwest 0.9x	0.77	x	22.01	x	97.38	x	0.4	x	1	=	594.16	(81)
Northwest 0.9x	0.77	x	47.6	x	91.1	x	0.4	x	0.8	=	961.64	(81)
Northwest 0.9x	0.77	x	22.01	x	91.1	x	0.4	x	1	=	555.82	(81)
Northwest 0.9x	0.77	x	47.6	x	72.63	x	0.4	x	0.8	=	766.63	(81)
Northwest 0.9x	0.77	x	22.01	x	72.63	x	0.4	x	1	=	443.11	(81)
Northwest 0.9x	0.77	x	47.6	x	50.42	x	0.4	x	0.8	=	532.23	(81)
Northwest 0.9x	0.77	x	22.01	x	50.42	x	0.4	x	1	=	307.63	(81)
Northwest 0.9x	0.77	x	47.6	x	28.07	x	0.4	x	0.8	=	296.27	(81)
Northwest 0.9x	0.77	x	22.01	x	28.07	x	0.4	x	1	=	171.24	(81)
Northwest 0.9x	0.77	x	47.6	x	14.2	x	0.4	x	0.8	=	149.86	(81)
Northwest 0.9x	0.77	x	22.01	x	14.2	x	0.4	x	1	=	86.62	(81)
Northwest 0.9x	0.77	x	47.6	x	9.21	x	0.4	x	0.8	=	97.26	(81)
Northwest 0.9x	0.77	x	22.01	x	9.21	x	0.4	x	1	=	56.22	(81)
Rooflights 0.9x	1	x	101.02	x	26	x	0.4	x	1	=	945.55	(82)
Rooflights 0.9x	1	x	101.02	x	54	x	0.4	x	1	=	1963.83	(82)
Rooflights 0.9x	1	x	101.02	x	96	x	0.4	x	1	=	3491.25	(82)
Rooflights 0.9x	1	x	101.02	x	150	x	0.4	x	1	=	5455.08	(82)
Rooflights 0.9x	1	x	101.02	x	192	x	0.4	x	1	=	6982.5	(82)
Rooflights 0.9x	1	x	101.02	x	200	x	0.4	x	1	=	7273.44	(82)
Rooflights 0.9x	1	x	101.02	x	189	x	0.4	x	1	=	6873.4	(82)
Rooflights 0.9x	1	x	101.02	x	157	x	0.4	x	1	=	5709.65	(82)
Rooflights 0.9x	1	x	101.02	x	115	x	0.4	x	1	=	4182.23	(82)
Rooflights 0.9x	1	x	101.02	x	66	x	0.4	x	1	=	2400.24	(82)
Rooflights 0.9x	1	x	101.02	x	33	x	0.4	x	1	=	1200.12	(82)
Rooflights 0.9x	1	x	101.02	x	21	x	0.4	x	1	=	763.71	(82)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	3153.12	5840.07	9121.53	13009.36	15993.72	16467.24	15633.67	13341.19	10470.16	6770.57	3864.94	2639.82	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	4749.76	7426.5	10642.76	14427.21	17300.51	17678.71	16792.34	14515.22	11706.32	8110.39	5320	4187.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.91	0.81	0.64	0.47	0.33	0.25	0.29	0.5	0.79	0.94	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.24	18.87	19.64	20.39	20.77	20.93	20.98	20.96	20.81	20.14	19.03	18.16	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.81	19.81	19.82	19.85	19.86	19.89	19.89	19.89	19.87	19.86	19.84	19.83	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.9	0.79	0.61	0.43	0.28	0.19	0.23	0.44	0.75	0.93	0.97	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.15	17.05	18.14	19.14	19.62	19.83	19.87	19.87	19.7	18.86	17.32	16.05	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.15	17.92	18.86	19.74	20.17	20.36	20.4	20.39	20.23	19.47	18.14	17.06	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.15	17.92	18.86	19.74	20.17	20.36	20.4	20.39	20.23	19.47	18.14	17.06	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.94	0.87	0.76	0.6	0.44	0.3	0.21	0.26	0.46	0.74	0.9	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	4480.38	6497.22	8140.06	8683.71	7600.52	5332.69	3597.71	3723.8	5365.26	5987.85	4813.89	4000.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	13349	13446.44	12692.33	10820.19	8407.72	5549.42	3662.75	3825.51	5981.83	8804.26	11082.66	13064.6	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	6598.26	4669.88	3386.89	1538.27	600.56	0	0	0	0	2095.41	4513.52	6743.67	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 30146.45 (98)

Space heating requirement in kWh/m²/year 38.91 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	9058.98	7131.54	7280.44	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.91	0.94	0.92	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	8265.7	6697.05	6673.56	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	19230.91	18271.35	15803.67	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	7894.95	8611.28	6792.79	0	0	0	0	

Total = Sum(104)$_{6\ldots8}$ = 23299.03 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.88 (105)

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104)$_{6\ldots8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	1740.2	1898.09	1497.26	0	0	0	0	

Total = Sum(107)$_{6\ldots8}$ = 5135.56 (107)

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Space cooling requirement in kWh/m²/year	(107) ÷ (4) =	6.63	(108)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		170	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)
Cooling System Energy Efficiency Ratio		3.83	(209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	6598.26	4669.88	3386.89	1538.27	600.56	0	0	0	0	2095.41	4513.52	6743.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	3881.33	2746.99	1992.29	904.86	353.27	0	0	0	0	1232.59	2655.01	3966.86	

(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 17733.21 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	230.99	202.88	211.39	187.17	181.73	159.96	151.32	169.22	169.92	194.2	208.27	224.65	

Efficiency of water heater 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	230.99	202.88	211.39	187.17	181.73	159.96	151.32	169.22	169.92	194.2	208.27	224.65	

Total = Sum(219a)$_{1...12}$ = 2291.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m÷ (209)

(221)m=	0	0	0	0	0	453.89	495.07	390.52	0	0	0	0	

Total = Sum(221)$_{6...8}$ = 1339.48 (221)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		17733.21	
Water heating fuel used		2291.69	
Space cooling fuel used		1339.48	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	3156.57		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	3156.57	(231)
Electricity for lighting		1228.36	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		25749.31	(338)

10a. Fuel costs - individual heating systems:

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	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		13.19	x 0.01 =	2339.01	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		13.19	x 0.01 =	0	(242)
Water heating (electric off-peak tariff)						
High-rate fraction (Table 13, or Appendix F for electric CPSU)				1		(243)
Low-rate fraction	1.0 – (243) =			0		(244)
High-rate cost	(219) x (243) x		13.19	x 0.01 =	302.27	(245)
Low-rate cost	(219) x (244) x		13.19	x 0.01 =	0	(246)
Space cooling	(221)		13.19	x 0.01 =	176.68	(248)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	416.35	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	162.02	(250)
Additional standing charges (Table 12)					0	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				3396.33	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.74	(257)
SAP rating (Section 12)	75.73	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	9203.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	1189.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =				10392.92	(265)
Space cooling	(221) x		0.519	=	695.19	(266)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	1638.26	(267)
Electricity for lighting	(232) x		0.519	=	637.52	(268)
Total CO2, kg/year		sum of (265)...(271) =			13363.89	(272)
CO2 emissions per m²		(272) ÷ (4) =			17.25	(273)
EI rating (section 14)					78	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		3.07	=	54440.95	(261)

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Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	7035.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =			61476.45	(265)
Space cooling	(221) x	3.07	=	4112.2	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	9690.66	(267)
Electricity for lighting	(232) x	0	=	3771.07	(268)
‘Total Primary Energy	sum of (265)…(271) =			79050.37	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			102.02	(273)

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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.54

Property Address: Level 41

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	774.83	(1a) x	3.61	(2a) =	2797.14	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	774.83	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		2797.14	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.01 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.26 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.26 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.34	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.3	0.31

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(25)

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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			10.23	x1/[1/(1.5)+ 0.04] =	14.48			(27)
Windows Type 2			2.69	x1/[1/(1.5)+ 0.04] =	3.81			(27)
Windows Type 3			2.69	x1/[1/(1.5)+ 0.04] =	3.81			(27)
Windows Type 4			20.07	x1/[1/(1.5)+ 0.04] =	28.4			(27)
Windows Type 5			10.23	x1/[1/(1.5)+ 0.04] =	14.48			(27)
Windows Type 6			20.07	x1/[1/(1.5)+ 0.04] =	28.4			(27)
Windows Type 7			9.33	x1/[1/(1.5)+ 0.04] =	13.2			(27)
Windows Type 8			9.32	x1/[1/(1.5)+ 0.04] =	13.19			(27)
Windows Type 9			9.32	x1/[1/(1.5)+ 0.04] =	13.19			(27)
Windows Type 10			9.28	x1/[1/(1.5)+ 0.04] =	13.13			(27)
Windows Type 11			3.88	x1/[1/(1.5)+ 0.04] =	5.49			(27)
Windows Type 12			3.88	x1/[1/(1.5)+ 0.04] =	5.49			(27)
Windows Type 13			20.07	x1/[1/(1.5)+ 0.04] =	28.4			(27)
Windows Type 14			20.07	x1/[1/(1.5)+ 0.04] =	28.4			(27)
Rooflights			42.58707	x1/[1/(1.7) + 0.04] =	72.39802			(27b)
Walls Type1	571.04	151.13	419.91	x 0.18 =	75.58			(29)
Walls Type2	35.91	0	35.91	x 0.18 =	6.46			(29)
Roof	774.83	42.59	732.24	x 0.13 =	95.19			(30)
Total area of elements, m²			1381.78					(31)

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Party wall	165.51	x	0	=	0		(32)
Party floor	774.83						(32a)
Internal wall **	1022.76						(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 458.89 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 87473.11 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 21.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 480.46 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	513.94	511.9	509.91	500.54	498.78	490.62	490.62	489.11	493.77	498.78	502.33	506.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	994.4	992.37	990.37	981	979.25	971.09	971.09	969.58	974.23	979.25	982.8	986.5	

Average = Sum(39)$_{1...12}$ /12= 980.99 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.28	1.28	1.27	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27	

Average = Sum(40)$_{1...12}$ /12= 1.27 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.75 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 123.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	135.57	130.64	125.71	120.78	115.85	110.92	110.92	115.85	120.78	125.71	130.64	135.57	

Total = Sum(44)$_{1...12}$ = 1478.92 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	201.04	175.83	181.44	158.19	151.79	130.98	121.37	139.28	140.94	164.25	179.29	194.7	

Total = Sum(45)$_{1...12}$ = 1939.1 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	30.16	26.38	27.22	23.73	22.77	19.65	18.21	20.89	21.14	24.64	26.89	29.2	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

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Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.83	24.23	26.83	25.96	26.83	25.96	26.83	26.83	25.96	26.83	25.96	26.83	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	251.14	221.08	231.54	206.66	201.88	179.46	171.46	189.37	189.41	214.34	227.77	244.79	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	251.14	221.08	231.54	206.66	201.88	179.46	171.46	189.37	189.41	214.34	227.77	244.79	

Output from water heater (annual)$_{1...12}$ 2528.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	106.92	94.66	100.4	91.38	90.54	82.33	80.43	86.38	85.64	94.69	98.4	104.81	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	187.46	187.46	187.46	187.46	187.46	187.46	187.46	187.46	187.46	187.46	187.46	187.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	69.55	61.78	50.24	38.04	28.43	24	25.94	33.71	45.25	57.46	67.06	71.49	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	780.19	788.29	767.89	724.46	669.63	618.1	583.68	575.58	595.98	639.42	694.24	745.77	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	41.75	41.75	41.75	41.75	41.75	41.75	41.75	41.75	41.75	41.75	41.75	41.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	-149.97	(71)

Water heating gains (Table 5)

(72)m=	143.71	140.86	134.95	126.91	121.7	114.35	108.1	116.11	118.95	127.27	136.66	140.88	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	1075.7	1073.17	1035.32	971.64	902	838.69	799.96	807.64	842.42	906.38	980.2	1040.37	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	2.69		10.63		0.63		0.7		8.74	(74)
North	0.9x	0.77	10.23		10.63		0.63		0.7		33.24	(74)
North	0.9x	0.77	3.88		10.63		0.63		0.7		12.61	(74)
North	0.9x	0.77	2.69		20.32		0.63		0.7		16.71	(74)
North	0.9x	0.77	10.23		20.32		0.63		0.7		63.53	(74)
North	0.9x	0.77	3.88		20.32		0.63		0.7		24.1	(74)
North	0.9x	0.77	2.69		34.53		0.63		0.7		28.39	(74)
North	0.9x	0.77	10.23		34.53		0.63		0.7		107.96	(74)
North	0.9x	0.77	3.88		34.53		0.63		0.7		40.95	(74)
North	0.9x	0.77	2.69		55.46		0.63		0.7		45.6	(74)
North	0.9x	0.77	10.23		55.46		0.63		0.7		173.41	(74)
North	0.9x	0.77	3.88		55.46		0.63		0.7		65.77	(74)
North	0.9x	0.77	2.69		74.72		0.63		0.7		61.42	(74)
North	0.9x	0.77	10.23		74.72		0.63		0.7		233.59	(74)
North	0.9x	0.77	3.88		74.72		0.63		0.7		88.6	(74)
North	0.9x	0.77	2.69		79.99		0.63		0.7		65.76	(74)
North	0.9x	0.77	10.23		79.99		0.63		0.7		250.07	(74)
North	0.9x	0.77	3.88		79.99		0.63		0.7		94.84	(74)
North	0.9x	0.77	2.69		74.68		0.63		0.7		61.39	(74)
North	0.9x	0.77	10.23		74.68		0.63		0.7		233.47	(74)
North	0.9x	0.77	3.88		74.68		0.63		0.7		88.55	(74)
North	0.9x	0.77	2.69		59.25		0.63		0.7		48.71	(74)
North	0.9x	0.77	10.23		59.25		0.63		0.7		185.23	(74)
North	0.9x	0.77	3.88		59.25		0.63		0.7		70.25	(74)
North	0.9x	0.77	2.69		41.52		0.63		0.7		34.13	(74)
North	0.9x	0.77	10.23		41.52		0.63		0.7		129.8	(74)
North	0.9x	0.77	3.88		41.52		0.63		0.7		49.23	(74)
North	0.9x	0.77	2.69		24.19		0.63		0.7		19.89	(74)
North	0.9x	0.77	10.23		24.19		0.63		0.7		75.63	(74)
North	0.9x	0.77	3.88		24.19		0.63		0.7		28.68	(74)

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North	0.9x	0.77	x	2.69	x	13.12	x	0.63	x	0.7	=	10.78	(74)
North	0.9x	0.77	x	10.23	x	13.12	x	0.63	x	0.7	=	41.01	(74)
North	0.9x	0.77	x	3.88	x	13.12	x	0.63	x	0.7	=	15.55	(74)
North	0.9x	0.77	x	2.69	x	8.86	x	0.63	x	0.7	=	7.29	(74)
North	0.9x	0.77	x	10.23	x	8.86	x	0.63	x	0.7	=	27.71	(74)
North	0.9x	0.77	x	3.88	x	8.86	x	0.63	x	0.7	=	10.51	(74)
Northeast	0.9x	0.77	x	20.07	x	11.28	x	0.63	x	0.7	=	69.21	(75)
Northeast	0.9x	0.77	x	9.33	x	11.28	x	0.63	x	0.7	=	32.17	(75)
Northeast	0.9x	0.77	x	20.07	x	22.97	x	0.63	x	0.7	=	140.87	(75)
Northeast	0.9x	0.77	x	9.33	x	22.97	x	0.63	x	0.7	=	65.49	(75)
Northeast	0.9x	0.77	x	20.07	x	41.38	x	0.63	x	0.7	=	253.8	(75)
Northeast	0.9x	0.77	x	9.33	x	41.38	x	0.63	x	0.7	=	117.99	(75)
Northeast	0.9x	0.77	x	20.07	x	67.96	x	0.63	x	0.7	=	416.82	(75)
Northeast	0.9x	0.77	x	9.33	x	67.96	x	0.63	x	0.7	=	193.77	(75)
Northeast	0.9x	0.77	x	20.07	x	91.35	x	0.63	x	0.7	=	560.28	(75)
Northeast	0.9x	0.77	x	9.33	x	91.35	x	0.63	x	0.7	=	260.46	(75)
Northeast	0.9x	0.77	x	20.07	x	97.38	x	0.63	x	0.7	=	597.32	(75)
Northeast	0.9x	0.77	x	9.33	x	97.38	x	0.63	x	0.7	=	277.68	(75)
Northeast	0.9x	0.77	x	20.07	x	91.1	x	0.63	x	0.7	=	558.78	(75)
Northeast	0.9x	0.77	x	9.33	x	91.1	x	0.63	x	0.7	=	259.76	(75)
Northeast	0.9x	0.77	x	20.07	x	72.63	x	0.63	x	0.7	=	445.47	(75)
Northeast	0.9x	0.77	x	9.33	x	72.63	x	0.63	x	0.7	=	207.09	(75)
Northeast	0.9x	0.77	x	20.07	x	50.42	x	0.63	x	0.7	=	309.26	(75)
Northeast	0.9x	0.77	x	9.33	x	50.42	x	0.63	x	0.7	=	143.77	(75)
Northeast	0.9x	0.77	x	20.07	x	28.07	x	0.63	x	0.7	=	172.15	(75)
Northeast	0.9x	0.77	x	9.33	x	28.07	x	0.63	x	0.7	=	80.03	(75)
Northeast	0.9x	0.77	x	20.07	x	14.2	x	0.63	x	0.7	=	87.08	(75)
Northeast	0.9x	0.77	x	9.33	x	14.2	x	0.63	x	0.7	=	40.48	(75)
Northeast	0.9x	0.77	x	20.07	x	9.21	x	0.63	x	0.7	=	56.52	(75)
Northeast	0.9x	0.77	x	9.33	x	9.21	x	0.63	x	0.7	=	26.27	(75)
Southeast	0.9x	0.77	x	9.32	x	36.79	x	0.63	x	0.7	=	104.8	(77)
Southeast	0.9x	0.77	x	20.07	x	36.79	x	0.63	x	0.7	=	225.68	(77)
Southeast	0.9x	0.77	x	9.32	x	62.67	x	0.63	x	0.7	=	178.51	(77)
Southeast	0.9x	0.77	x	20.07	x	62.67	x	0.63	x	0.7	=	384.42	(77)
Southeast	0.9x	0.77	x	9.32	x	85.75	x	0.63	x	0.7	=	244.25	(77)
Southeast	0.9x	0.77	x	20.07	x	85.75	x	0.63	x	0.7	=	525.98	(77)
Southeast	0.9x	0.77	x	9.32	x	106.25	x	0.63	x	0.7	=	302.64	(77)
Southeast	0.9x	0.77	x	20.07	x	106.25	x	0.63	x	0.7	=	651.71	(77)
Southeast	0.9x	0.77	x	9.32	x	119.01	x	0.63	x	0.7	=	338.98	(77)
Southeast	0.9x	0.77	x	20.07	x	119.01	x	0.63	x	0.7	=	729.97	(77)
Southeast	0.9x	0.77	x	9.32	x	118.15	x	0.63	x	0.7	=	336.53	(77)

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Southeast	0.9x	0.77	x	20.07	x	118.15	x	0.63	x	0.7	=	724.69	(77)
Southeast	0.9x	0.77	x	9.32	x	113.91	x	0.63	x	0.7	=	324.45	(77)
Southeast	0.9x	0.77	x	20.07	x	113.91	x	0.63	x	0.7	=	698.68	(77)
Southeast	0.9x	0.77	x	9.32	x	104.39	x	0.63	x	0.7	=	297.34	(77)
Southeast	0.9x	0.77	x	20.07	x	104.39	x	0.63	x	0.7	=	640.29	(77)
Southeast	0.9x	0.77	x	9.32	x	92.85	x	0.63	x	0.7	=	264.47	(77)
Southeast	0.9x	0.77	x	20.07	x	92.85	x	0.63	x	0.7	=	569.52	(77)
Southeast	0.9x	0.77	x	9.32	x	69.27	x	0.63	x	0.7	=	197.3	(77)
Southeast	0.9x	0.77	x	20.07	x	69.27	x	0.63	x	0.7	=	424.86	(77)
Southeast	0.9x	0.77	x	9.32	x	44.07	x	0.63	x	0.7	=	125.53	(77)
Southeast	0.9x	0.77	x	20.07	x	44.07	x	0.63	x	0.7	=	270.31	(77)
Southeast	0.9x	0.77	x	9.32	x	31.49	x	0.63	x	0.7	=	89.69	(77)
Southeast	0.9x	0.77	x	20.07	x	31.49	x	0.63	x	0.7	=	193.14	(77)
South	0.9x	0.77	x	10.23	x	46.75	x	0.63	x	0.7	=	146.17	(78)
South	0.9x	0.77	x	2.69	x	46.75	x	0.63	x	0.7	=	38.43	(78)
South	0.9x	0.77	x	3.88	x	46.75	x	0.63	x	0.7	=	55.44	(78)
South	0.9x	0.77	x	10.23	x	76.57	x	0.63	x	0.7	=	239.38	(78)
South	0.9x	0.77	x	2.69	x	76.57	x	0.63	x	0.7	=	62.95	(78)
South	0.9x	0.77	x	3.88	x	76.57	x	0.63	x	0.7	=	90.79	(78)
South	0.9x	0.77	x	10.23	x	97.53	x	0.63	x	0.7	=	304.93	(78)
South	0.9x	0.77	x	2.69	x	97.53	x	0.63	x	0.7	=	80.18	(78)
South	0.9x	0.77	x	3.88	x	97.53	x	0.63	x	0.7	=	115.65	(78)
South	0.9x	0.77	x	10.23	x	110.23	x	0.63	x	0.7	=	344.64	(78)
South	0.9x	0.77	x	2.69	x	110.23	x	0.63	x	0.7	=	90.62	(78)
South	0.9x	0.77	x	3.88	x	110.23	x	0.63	x	0.7	=	130.71	(78)
South	0.9x	0.77	x	10.23	x	114.87	x	0.63	x	0.7	=	359.14	(78)
South	0.9x	0.77	x	2.69	x	114.87	x	0.63	x	0.7	=	94.44	(78)
South	0.9x	0.77	x	3.88	x	114.87	x	0.63	x	0.7	=	136.21	(78)
South	0.9x	0.77	x	10.23	x	110.55	x	0.63	x	0.7	=	345.62	(78)
South	0.9x	0.77	x	2.69	x	110.55	x	0.63	x	0.7	=	90.88	(78)
South	0.9x	0.77	x	3.88	x	110.55	x	0.63	x	0.7	=	131.09	(78)
South	0.9x	0.77	x	10.23	x	108.01	x	0.63	x	0.7	=	337.69	(78)
South	0.9x	0.77	x	2.69	x	108.01	x	0.63	x	0.7	=	88.8	(78)
South	0.9x	0.77	x	3.88	x	108.01	x	0.63	x	0.7	=	128.08	(78)
South	0.9x	0.77	x	10.23	x	104.89	x	0.63	x	0.7	=	327.94	(78)
South	0.9x	0.77	x	2.69	x	104.89	x	0.63	x	0.7	=	86.23	(78)
South	0.9x	0.77	x	3.88	x	104.89	x	0.63	x	0.7	=	124.38	(78)
South	0.9x	0.77	x	10.23	x	101.89	x	0.63	x	0.7	=	318.54	(78)
South	0.9x	0.77	x	2.69	x	101.89	x	0.63	x	0.7	=	83.76	(78)
South	0.9x	0.77	x	3.88	x	101.89	x	0.63	x	0.7	=	120.81	(78)
South	0.9x	0.77	x	10.23	x	82.59	x	0.63	x	0.7	=	258.2	(78)

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South	0.9x	0.77	x	2.69	x	82.59	x	0.63	x	0.7	=	67.89	(78)
South	0.9x	0.77	x	3.88	x	82.59	x	0.63	x	0.7	=	97.93	(78)
South	0.9x	0.77	x	10.23	x	55.42	x	0.63	x	0.7	=	173.26	(78)
South	0.9x	0.77	x	2.69	x	55.42	x	0.63	x	0.7	=	45.56	(78)
South	0.9x	0.77	x	3.88	x	55.42	x	0.63	x	0.7	=	65.71	(78)
South	0.9x	0.77	x	10.23	x	40.4	x	0.63	x	0.7	=	126.3	(78)
South	0.9x	0.77	x	2.69	x	40.4	x	0.63	x	0.7	=	33.21	(78)
South	0.9x	0.77	x	3.88	x	40.4	x	0.63	x	0.7	=	47.9	(78)
Southwest	0.9x	0.77	x	9.32	x	36.79		0.63	x	0.7	=	104.8	(79)
Southwest	0.9x	0.77	x	20.07	x	36.79		0.63	x	0.7	=	225.68	(79)
Southwest	0.9x	0.77	x	9.32	x	62.67		0.63	x	0.7	=	178.51	(79)
Southwest	0.9x	0.77	x	20.07	x	62.67		0.63	x	0.7	=	384.42	(79)
Southwest	0.9x	0.77	x	9.32	x	85.75		0.63	x	0.7	=	244.25	(79)
Southwest	0.9x	0.77	x	20.07	x	85.75		0.63	x	0.7	=	525.98	(79)
Southwest	0.9x	0.77	x	9.32	x	106.25		0.63	x	0.7	=	302.64	(79)
Southwest	0.9x	0.77	x	20.07	x	106.25		0.63	x	0.7	=	651.71	(79)
Southwest	0.9x	0.77	x	9.32	x	119.01		0.63	x	0.7	=	338.98	(79)
Southwest	0.9x	0.77	x	20.07	x	119.01		0.63	x	0.7	=	729.97	(79)
Southwest	0.9x	0.77	x	9.32	x	118.15		0.63	x	0.7	=	336.53	(79)
Southwest	0.9x	0.77	x	20.07	x	118.15		0.63	x	0.7	=	724.69	(79)
Southwest	0.9x	0.77	x	9.32	x	113.91		0.63	x	0.7	=	324.45	(79)
Southwest	0.9x	0.77	x	20.07	x	113.91		0.63	x	0.7	=	698.68	(79)
Southwest	0.9x	0.77	x	9.32	x	104.39		0.63	x	0.7	=	297.34	(79)
Southwest	0.9x	0.77	x	20.07	x	104.39		0.63	x	0.7	=	640.29	(79)
Southwest	0.9x	0.77	x	9.32	x	92.85		0.63	x	0.7	=	264.47	(79)
Southwest	0.9x	0.77	x	20.07	x	92.85		0.63	x	0.7	=	569.52	(79)
Southwest	0.9x	0.77	x	9.32	x	69.27		0.63	x	0.7	=	197.3	(79)
Southwest	0.9x	0.77	x	20.07	x	69.27		0.63	x	0.7	=	424.86	(79)
Southwest	0.9x	0.77	x	9.32	x	44.07		0.63	x	0.7	=	125.53	(79)
Southwest	0.9x	0.77	x	20.07	x	44.07		0.63	x	0.7	=	270.31	(79)
Southwest	0.9x	0.77	x	9.32	x	31.49		0.63	x	0.7	=	89.69	(79)
Southwest	0.9x	0.77	x	20.07	x	31.49		0.63	x	0.7	=	193.14	(79)
Northwest	0.9x	0.77	x	20.07	x	11.28	x	0.63	x	0.7	=	69.21	(81)
Northwest	0.9x	0.77	x	9.28	x	11.28	x	0.63	x	0.7	=	32	(81)
Northwest	0.9x	0.77	x	20.07	x	22.97	x	0.63	x	0.7	=	140.87	(81)
Northwest	0.9x	0.77	x	9.28	x	22.97	x	0.63	x	0.7	=	65.14	(81)
Northwest	0.9x	0.77	x	20.07	x	41.38	x	0.63	x	0.7	=	253.8	(81)
Northwest	0.9x	0.77	x	9.28	x	41.38	x	0.63	x	0.7	=	117.35	(81)
Northwest	0.9x	0.77	x	20.07	x	67.96	x	0.63	x	0.7	=	416.82	(81)
Northwest	0.9x	0.77	x	9.28	x	67.96	x	0.63	x	0.7	=	192.73	(81)
Northwest	0.9x	0.77	x	20.07	x	91.35	x	0.63	x	0.7	=	560.28	(81)

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Northwest 0.9x	0.77	x	9.28	x	91.35	x	0.63	x	0.7	=	259.07	(81)
Northwest 0.9x	0.77	x	20.07	x	97.38	x	0.63	x	0.7	=	597.32	(81)
Northwest 0.9x	0.77	x	9.28	x	97.38	x	0.63	x	0.7	=	276.19	(81)
Northwest 0.9x	0.77	x	20.07	x	91.1	x	0.63	x	0.7	=	558.78	(81)
Northwest 0.9x	0.77	x	9.28	x	91.1	x	0.63	x	0.7	=	258.37	(81)
Northwest 0.9x	0.77	x	20.07	x	72.63	x	0.63	x	0.7	=	445.47	(81)
Northwest 0.9x	0.77	x	9.28	x	72.63	x	0.63	x	0.7	=	205.98	(81)
Northwest 0.9x	0.77	x	20.07	x	50.42	x	0.63	x	0.7	=	309.26	(81)
Northwest 0.9x	0.77	x	9.28	x	50.42	x	0.63	x	0.7	=	143	(81)
Northwest 0.9x	0.77	x	20.07	x	28.07	x	0.63	x	0.7	=	172.15	(81)
Northwest 0.9x	0.77	x	9.28	x	28.07	x	0.63	x	0.7	=	79.6	(81)
Northwest 0.9x	0.77	x	20.07	x	14.2	x	0.63	x	0.7	=	87.08	(81)
Northwest 0.9x	0.77	x	9.28	x	14.2	x	0.63	x	0.7	=	40.26	(81)
Northwest 0.9x	0.77	x	20.07	x	9.21	x	0.63	x	0.7	=	56.52	(81)
Northwest 0.9x	0.77	x	9.28	x	9.21	x	0.63	x	0.7	=	26.13	(81)
Rooflights 0.9x	1	x	42.59	x	26	x	0.63	x	0.7	=	439.47	(82)
Rooflights 0.9x	1	x	42.59	x	54	x	0.63	x	0.7	=	912.75	(82)
Rooflights 0.9x	1	x	42.59	x	96	x	0.63	x	0.7	=	1622.67	(82)
Rooflights 0.9x	1	x	42.59	x	150	x	0.63	x	0.7	=	2535.42	(82)
Rooflights 0.9x	1	x	42.59	x	192	x	0.63	x	0.7	=	3245.34	(82)
Rooflights 0.9x	1	x	42.59	x	200	x	0.63	x	0.7	=	3380.56	(82)
Rooflights 0.9x	1	x	42.59	x	189	x	0.63	x	0.7	=	3194.63	(82)
Rooflights 0.9x	1	x	42.59	x	157	x	0.63	x	0.7	=	2653.74	(82)
Rooflights 0.9x	1	x	42.59	x	115	x	0.63	x	0.7	=	1943.82	(82)
Rooflights 0.9x	1	x	42.59	x	66	x	0.63	x	0.7	=	1115.59	(82)
Rooflights 0.9x	1	x	42.59	x	33	x	0.63	x	0.7	=	557.79	(82)
Rooflights 0.9x	1	x	42.59	x	21	x	0.63	x	0.7	=	354.96	(82)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	1597.65	2948.43	4584.13	6515	7996.73	8229.77	7814.56	6675.75	5253.37	3412.06	1956.25	1338.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	2673.35	4021.6	5619.44	7486.64	8898.72	9068.46	8614.52	7483.39	6095.79	4318.43	2936.45	2379.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.64	0.49	0.57	0.86	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.35	19.58	19.96	20.44	20.8	20.96	20.99	20.98	20.83	20.3	19.73	19.32	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.85	19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.87	19.87	19.87	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.78	0.55	0.37	0.44	0.79	0.98	1	1	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.64	17.98	18.53	19.21	19.68	19.85	19.87	19.87	19.73	19.03	18.2	17.59	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.46	18.75	19.21	19.8	20.22	20.38	20.41	20.4	20.26	19.64	18.93	18.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.46	18.75	19.21	19.8	20.22	20.38	20.41	20.4	20.26	19.64	18.93	18.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.93	0.8	0.59	0.42	0.51	0.82	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	2672.32	4011.79	5543.87	6994.23	7080.28	5371.34	3658.08	3792.89	4981.53	4239.14	2932.8	2378.81	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	14077.79	13741.13	12590.08	10693.13	8338.82	5611.81	3698.27	3880.25	5996.99	8848.87	11624.95	14025.9	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	8485.67	6538.12	5242.38	2663.2	936.35	0	0	0	0	3429.64	6258.35	8665.43	

Total per year (kWh/year) = Sum(98)$_{1...5,9,...12}$ = 42219.14 (98)

Space heating requirement in kWh/m²/year 54.49 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	8485.67	6538.12	5242.38	2663.2	936.35	0	0	0	0	3429.64	6258.35	8665.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	9075.58	6992.64	5606.82	2848.35	1001.45	0	0	0	0	3668.06	6693.42	9267.84	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 45154.16 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	251.14	221.08	231.54	206.66	201.88	179.46	171.46	189.37	189.41	214.34	227.77	244.79

Efficiency of water heater 79.8 (216)

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(217)m=	90.15	90.1	89.99	89.63	88.4	79.8	79.8	79.8	79.8	89.79	90.08	90.17

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	278.57	245.36	257.29	230.56	228.37	224.88	214.87	237.3	237.36	238.71	252.86	271.48

Total = Sum(219a)$_{1...12}$ = 2917.62 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		45154.16
Water heating fuel used		2917.62
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30 (230c)	
boiler with a fan-assisted flue	45 (230e)	
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		1228.36 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		49375.15 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	9753.3	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	630.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				10383.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	637.52	(268)
Total CO2, kg/year	sum of (265)…(271) =				11059.95	(272)

TER = 21.64 (273)

DRAFT

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 26 August 2022

Property Details: Level 41

Dwelling type:	Flat
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	3692.22	**(P1)**
Transmission heat loss coefficient:	636	
Summer heat loss coefficient:	4328.26	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South (S 41)	0	1
North (N 41 GLAZED DOOR)	0	1
South (S 41 GLAZED DOOR)	0	1
North East (NE 41)	0	1
North (N 41)	0	1
North West (NW 41)	0	1
North East (NE MEZ)	0	1
South East (SE MEZ)	0	1
South West (SW MEZ)	0	1
North West (NW MEZ)	0	1
North (N MEZ)	0	1
South (S MEZ)	0	1
South East (SE 41)	0	1
South West (SW 41)	0	1
Horizontal (ROOF LIGHT)	0	1

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Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South (S 41)	1	0.9	1	0.9	**(P8)**
North (N 41 GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
South (S 41 GLAZED DOOR)	1	0.9	1	0.9	**(P8)**
North East (NE 41)	1	0.9	1	0.9	**(P8)**
North (N 41)	1	0.9	1	0.9	**(P8)**
North West (NW 41)	1	0.9	1	0.9	**(P8)**
North East (NE MEZ)	1	0.9	1	0.9	**(P8)**
South East (SE MEZ)	1	0.9	1	0.9	**(P8)**
South West (SW MEZ)	1	0.9	1	0.9	**(P8)**
North West (NW MEZ)	1	0.9	1	0.9	**(P8)**
North (N MEZ)	1	0.9	1	0.9	**(P8)**
South (S MEZ)	1	0.9	1	0.9	**(P8)**

SAP 2012 Overheating Assessment

South East (SE 41)	1	0.9	1	0.9	**(P8)**
South West (SW 41)	1	0.9	1	0.9	**(P8)**
Horizontal (ROOF LIGHT)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South (S 41)	0.9 x	24.27	106.3	0.4	1	0.9	835.87	
North (N 41 GLAZED DOOR)	0.9 x	6.39	73.49	0.4	0.7	0.9	106.51	
South (S 41 GLAZED DOOR)	0.9 x	6.39	106.3	0.4	0.7	0.9	154.05	
North East (NE 41)	0.9 x	47.6	89.66	0.4	0.8	0.9	1106.16	
North (N 41)	0.9 x	24.27	73.49	0.4	1	0.9	577.9	
North West (NW 41)	0.9 x	47.6	89.66	0.4	0.8	0.9	1106.16	
North East (NE MEZ)	0.9 x	22.12	89.66	0.4	1	0.9	642.55	
South East (SE MEZ)	0.9 x	22.11	112.1	0.4	1	0.9	803.05	
South West (SW MEZ)	0.9 x	22.11	112.1	0.4	1	0.9	803.05	
North West (NW MEZ)	0.9 x	22.01	89.66	0.4	1	0.9	639.35	
North (N MEZ)	0.9 x	9.2	73.49	0.4	1	0.9	219.06	
South (S MEZ)	0.9 x	9.2	106.3	0.4	1	0.9	316.85	
South East (SE 41)	0.9 x	47.6	112.1	0.4	0.8	0.9	1383.1	
South West (SW 41)	0.9 x	47.6	112.1	0.4	0.8	0.9	1383.1	
	1 x	101.02	186	0.4	1	1	6764.3	
						Total	16841.05	**(P3/P4)**

Internal gains:

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	June	**July**	**August**	
Internal gains	1211.46	1158.67	1174.03	
Total summer gains	19501.2	17999.72	15337.75	**(P5)**
Summer gain/loss ratio	4.51	4.16	3.54	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.51	21.86	21.14	**(P7)**
Likelihood of high internal temperature	**Slight**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

Appendix B

BRUKL report (issued separately)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

P1785 - St. Michael's

As designed

Date: Tue Aug 23 12:33:43 2022

Administrative information

Building Details

Address: Address 1, Manchester, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.15

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Ben Duckworth

Telephone number: 0113 257 7300

Address: 7 Feast Field, Horsforth, West Yorkshire, Leeds, LS18 4TJ

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	30
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	30
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	28.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.25	0.26	B3000002:Surf[1]
Floor	0.25	0.15	0.18	B3000002:Surf[0]
Roof	0.25	0.15	0.15	B1000011:Surf[4]
Windows***, roof windows, and rooflights	2.2	1	1	SP00001A:Surf[1]
Personnel doors	2.2	2.2	2.2	00000015:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- System 7 - Electric Panel Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- System 6 - Electric Panel Mech Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	0.85
Standard value	N/A	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- System 5 - Basement VRF Mech Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.79	3.8	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

4- System 8 - Data Room AC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.79	3.8	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

5- System 1 - Office VRF Mech Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.79	3.8	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

6- System 2 - Ground Floor VRF Mech Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.79	3.8	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

7- System 4 - Hotel Lobby VRF Mech Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.79	3.8	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

8- System 3 - Hotel VRF Mech Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.79	3.8	0	-	0.85
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- System 11 - Instantaneous DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
B2 - Uniform/Housekeeping 08	-	-	0.3	-	-	-	-	-	-	-	N/A
B2 - Laundry 09	-	-	0.3	-	-	-	-	-	-	-	N/A
B2 - Staff Changing 10	-	-	-	1.2	-	-	-	-	-	-	N/A
B2 - Staff Changing 11	-	-	-	1.2	-	-	-	-	-	-	N/A
B2 - IT Office 02	-	-	-	1.2	-	-	-	-	-	-	N/A
B2 - Room 1	-	-	-	1.2	-	-	-	-	-	-	N/A
B2 - Gym/Spa	-	-	-	1.2	-	-	-	-	-	-	N/A
B1 - Changing 12	-	-	-	1.2	-	-	-	-	-	-	N/A
02 - Open Plan Office	-	-	-	1.2	-	-	-	-	-	-	N/A
02 - Male WC	-	-	0.3	-	-	-	-	-	-	-	N/A
02 - Female WC	-	-	0.3	-	-	-	-	-	-	-	N/A
03 - Open Plan Office	-	-	-	1.2	-	-	-	-	-	-	N/A
03 - Male WC	-	-	0.3	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
03 - Female WC	-	-	0.3	-	-	-	-	-	-	-	N/A
04 - Open Plan Office	-	-	-	1.2	-	-	-	-	-	-	N/A
04 - Male WC	-	-	0.3	-	-	-	-	-	-	-	N/A
04 - Female WC	-	-	0.3	-	-	-	-	-	-	-	N/A
05 - Open Plan Office	-	-	-	1.2	-	-	-	-	-	-	N/A
05 - Male WC	-	-	0.3	-	-	-	-	-	-	-	N/A
05 - Female WC	-	-	0.3	-	-	-	-	-	-	-	N/A
00 - WC 06.07	-	-	0.3	-	-	-	-	-	-	-	N/A
00 - Kitchen 01.16	-	-	0.3	-	-	-	-	-	-	-	N/A
00 - WC 01.12	-	-	0.3	-	-	-	-	-	-	-	N/A
00 - Admin/BOH 01.18	-	-	-	1.2	-	-	-	-	-	-	N/A
00 - BOH Kitchen 01.07	-	-	-	1.2	-	-	-	-	-	-	N/A
00 - BOH 01.05	-	-	-	1.2	-	-	-	-	-	-	N/A
01 - Male WC	-	-	0.3	-	-	-	-	-	-	-	N/A
01 - Female WC	-	-	0.3	-	-	-	-	-	-	-	N/A
01 - Satff Offices 01.03	-	-	-	1.2	-	-	-	-	-	-	N/A
01 - Staff Canteen 01.02	-	-	0.3	-	-	-	-	-	-	-	N/A
01 - Open Plan Office 01.01	-	-	-	1.2	-	-	-	-	-	-	N/A
06 - Toilets 06.03	-	-	0.3	-	-	-	-	-	-	-	N/A
06 - Toilets 06.02	-	-	0.3	-	-	-	-	-	-	-	N/A
06 - Hotel 06.01	-	-	-	1.2	-	-	-	-	-	-	N/A
07 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
07 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
08 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
08 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
09 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
10 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
10 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
11 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
12 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
13 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
13 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.01	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Twin Room 07.11	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Access King Room 07.17	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.16	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Twin Room 07.15	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Twin Room 07.14	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.12	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.13	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.02	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Twin Room 07.09	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Access King Room 07.03	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.04	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Twin Room 07.05	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - Twin Room 07.06	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.08	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - King Room 07.07	-	-	-	0.5	-	-	-	-	-	-	N/A
14 - WS Suite 07.10	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - King Room 15.01	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - King Room 15.11	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - King Room 15.11	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - Twin Room 15.10	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - Twin Room 15.09	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - King Room 15.08	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - King Room 15.02	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - Access King Room 15.03	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - WOW Suite 15.06	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - WOW Suite 15.07	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - W Suite 15.05	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - W Suite 15.04	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - King Room 16.01	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - Access King Room 16.14	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - King Room 16.13	-	-	-	0.5	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
16 - Twin Room 16.12	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - Twin Room 16.11	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - King Room 16.10	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - King Room 16.02	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - Access King Room 16.03	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - W Suite 16.06	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - King Room 16.07	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - E WOW Suite 16.08	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - King Room 16.09	-	-	-	0.5	-	-	-	-	-	-	N/A
15 - King Room 16.04	-	-	-	0.5	-	-	-	-	-	-	N/A
16 - King Room 16.05	-	-	-	0.5	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
B3 - Plant 04	78	-	-	309
B3 - Plant 05	78	-	-	299
B3 - Stairs	-	125	-	79
B3 - Plant 03	85	-	-	144
B3 - Lobby	-	204	-	23
B3 - Plant 02	73	-	-	2554
B3 - Core	-	100	-	988
B3 - Plant 01	74	-	-	1671
B2 - Switch Room 06	53	-	-	412
B2 - Stairs	-	125	-	80
B2 - Plant 05	81	-	-	208
B2 - Generator Room 07	51	-	-	890
B2 - Uniform/Housekeeping 08	-	108	-	578
B2 - Laundry 09	-	107	-	663
B2 - Staff Changing 10	-	130	-	150
B2 - Staff Changing 11	-	130	-	149
B2 - Data Room 01	56	-	-	56
B2 - IT Office 02	72	-	-	262
B2 - Lobby 1	-	184	-	29
B2 - Stair Core 3	-	109	-	151
B2 - Residential Lobby 04	-	135	-	50
B2 - Stair Core 2	-	114	-	101
B2 - Stair Core 1	-	133	-	53
B2 - Room 1	66	-	-	430
B2 - Gym/Spa	-	98	-	3104
B2 - Main Corridor	-	146	-	281
B2 - Store 2	109	-	-	8
B2 -Store 1	119	-	-	6

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B1 - Room 2	74	-	-	20
B1 - Room 3	66	-	-	33
B1 - Room 1	72	-	-	32
B1 - Room 4	73	-	-	21
B1 - Core 1	67	-	-	207
B1 Core 2	57	-	-	408
B1 - Core 3	54	-	-	607
B1 - Store 2	108	-	-	8
B1 - Store 1	120	-	-	6
B1 - Bin Store 04	56	-	-	63
B1 - Bin Store 05	54	-	-	101
B1 - Bin Store 03	55	-	-	181
B1 - Stairs 2	62	-	-	331
B1 - Switch Room 09	65	-	-	114
B1 - Attenuation Tank 07	53	-	-	426
B1 - Cycle Store Lobby	-	213	-	18
B1 - Cycle Store 10	50	-	-	314
B1 - Bin Lobby	-	147	-	55
B1 - Changing 12	-	141	-	70
B1 - Cycle Store 13	51	-	-	224
B1 - Changing Lobby	-	151	-	47
B1 - Stairs 1	74	-	-	322
B1 - Corridor 1	-	154	-	38
B1 - Corridor 2	-	121	-	323
B1 - Corridor 3	-	114	-	324
B1 Residential Lobby 06	-	128	-	124
02 -- Store 4	81	-	-	17
02 - Stairs 4	-	121	-	95
02 - Open Plan Office	98	-	-	9250
02 - Male WC	-	122	-	181
02 - Stairs 1	-	120	-	98
02 - Store 1	99	-	-	11
02 - Store 2	98	-	-	11
02 - Lobby	-	147	-	64
02 - Lift Lobby/Lift	-	117	-	106
02 - Stairs 2	-	141	-	52
02 - Hotel Lift Lobby	-	148	-	47
02 - Main Corridor	-	116	-	294
02 - Female WC	-	119	-	215
02 - Stairs 3	-	144	-	49
02 - Lift Lobby	-	214	-	21
02 - Store 3	100	-	-	11
03 - Store 4	81	-	-	17

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
03 - Stairs 4	-	121	-	95
03 - Open Plan Office	98	-	-	9250
03 - Male WC	-	122	-	181
03 - Stairs 1	-	120	-	98
03 - Store 1	99	-	-	11
03 - Store 2	98	-	-	11
03 - Lobby	-	147	-	64
03 - Lift Lobby/Lift	-	117	-	106
03 - Stairs 2	-	141	-	52
03 - Hotel Lift Lobby	-	148	-	47
03 - Main Corridor	-	116	-	294
03 - Female WC	-	119	-	215
03 - Stairs 3	-	144	-	49
03 - Lift Lobby	-	214	-	21
03 - Store 3	100	-	-	11
04 - Store 4	81	-	-	17
04 - Stairs 4	-	121	-	95
04 - Open Plan Office	98	-	-	9250
04 - Male WC	-	122	-	181
04 - Stairs 1	-	120	-	98
04 - Store 1	99	-	-	11
04 - Store 2	98	-	-	11
04 - Lobby	-	147	-	64
04 - Lift Lobby/Lift	-	117	-	106
04 - Stairs 2	-	141	-	52
04 - Hotel Lift Lobby	-	148	-	47
04 - Main Corridor	-	116	-	294
04 - Female WC	-	119	-	215
04 - Stairs 3	-	144	-	49
04 - Lift Lobby	-	214	-	21
04 - Store 3	100	-	-	11
05 - Store 4	81	-	-	17
05 - Stairs 4	-	121	-	95
05 - Open Plan Office	98	-	-	9250
05 - Male WC	-	122	-	181
05 - Stairs 1	-	120	-	98
05 - Store 1	99	-	-	11
05 - Store 2	98	-	-	11
05 - Lobby	-	147	-	64
05 - Lift Lobby/Lift	-	117	-	106
05 - Stairs 2	-	141	-	52
05 - Hotel Lift Lobby	-	148	-	47
05 - Main Corridor	-	116	-	294

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
05 - Female WC	-	119	-	215
05 - Stairs 3	-	144	-	49
05 - Lift Lobby	-	214	-	21
05 - Store 3	100	-	-	11
00 - Entrance Lobby	-	106	15	720
00 - Lift Lobby/Business Lounge	-	139	-	203
00 - Stairs 1	-	243	-	55
00 - WC 06.07	-	258	-	43
00 - Post 01.15	100	-	-	17
00 - Kitchen 01.16	-	244	-	118
00 - WC 01.12	-	285	-	38
00 - Escape Stair	-	137	-	156
00 - Substation 01.09	80	-	-	106
00 - Substation 01.35	80	-	-	106
00 - Substation 01.10	81	-	-	105
00 - Conference Facilities 01.06	61	-	-	2893
00 - Circulation 01.19	-	263	-	21
00 - Admin/BOH 01.18	81	-	-	452
00 - Corridor	-	182	-	184
00 - H/S Lift Lobby	-	198	-	45
00 - Stair Core 3	-	120	-	153
00 - BOH Kitchen 01.07	-	130	-	582
00 - BOH Kitchen Lobby	-	173	-	120
00 - Hotel Lobby 01.04	-	103	-	865
00 - BOH 01.05	90	-	-	213
00 - Stair Core 2	-	130	-	103
00 - Stair Core 1	-	170	-	51
00 - Cirulation 01.23	-	144	-	185
00 - Residential Lobby 01.20	-	130	-	308
00 - Stairs 3	-	193	-	49
00 - Stairs 2	-	208	-	45
01 - Store 4	81	-	-	17
01 - Stairs 4	-	121	-	95
01 - Male WC	-	122	-	181
01 - Stairs 1	-	120	-	98
01 - Store 1	99	-	-	11
01 - Store 2	98	-	-	11
01 - Lobby	-	147	-	64
01 - Stairs 2	-	141	-	52
01 - Hotel Lift Lobby	-	148	-	47
01 - Main Corridor	-	116	-	294
01 - Female WC	-	119	-	215
02 - Stairs 3	-	144	-	49

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 - Lift Lobby	-	214	-	21
01 - Store 3	100	-	-	11
01 - Satff Offices 01.03	68	-	-	571
01 - Staff Canteen 01.02	-	136	-	215
01 - Office Lobby	-	147	-	82
01 - Plant 01.04	50	-	-	1423
01 - Open Plan Office 01.01	98	-	-	6380
06 - Circulation	-	110	-	478
06 - Stairs	-	138	-	98
06 - Circulation	-	135	-	226
06 - Room 2	75	-	-	46
06 - Store 2	150	-	-	7
06 - Toilets Lobby	-	301	-	24
06 - Toilets 06.03	-	161	-	139
06 - Circulation	-	108	-	721
06 - Room 1	76	-	-	42
06 - Toilets 06.02	-	151	-	155
06 - Hotel 06.01	-	201	-	1766
06 - Stair Core	-	111	-	500
06 - Store 1	150	-	-	5
01 - Toilets Lobby	-	301	-	13
07 - King Room 07.01	-	223	-	55
07 - Twin Room 07.11	-	238	-	49
07 - Access King Room 07.17	-	221	-	64
07 - King Room 07.16	-	225	-	48
07 - Twin Room 07.15	-	221	-	55
07 - Twin Room 07.14	-	221	-	55
07 - King Room 07.12	-	223	-	53
07 - King Room 07.13	-	225	-	48
07 - King Room 07.02	-	223	-	55
07 - Twin Room 07.09	-	238	-	49
07 - Access King Room 07.03	-	221	-	64
07 - King Room 07.04	-	225	-	48
07 - Twin Room 07.05	-	221	-	55
07 - Twin Room 07.06	-	221	-	55
07 - King Room 07.08	-	223	-	53
07 - King Room 07.07	-	225	-	48
07 - WS Suite 07.10	-	208	-	124
07 - Stairs	-	126	-	53
07 - Resi Lift Lobby	-	152	-	29
07 - Riser Lobby	-	222	-	13
07 - Corridor 3	-	127	-	222
07 - Stair	-	128	-	49

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
07 - Lift Lobby	-	176	-	21
07 - Corridor 2	-	123	-	157
07 - Corridor 1	-	123	-	165
08 - King Room 07.01	-	223	-	55
08 - Twin Room 07.11	-	238	-	49
08 - Access King Room 07.17	-	221	-	64
08 - King Room 07.16	-	225	-	48
08 - Twin Room 07.15	-	221	-	55
08 - Twin Room 07.14	-	221	-	55
08 - King Room 07.12	-	223	-	53
08 - King Room 07.13	-	225	-	48
08 - King Room 07.02	-	223	-	55
08 - Twin Room 07.09	-	238	-	49
08 - Access King Room 07.03	-	221	-	64
08 - King Room 07.04	-	225	-	48
08 - Twin Room 07.05	-	221	-	55
08 - Twin Room 07.06	-	221	-	55
08 - King Room 07.08	-	223	-	53
08 - King Room 07.07	-	225	-	48
08 - WS Suite 07.10	-	208	-	124
08 - Stairs	-	126	-	53
08 - Resi Lift Lobby	-	152	-	29
08 - Riser Lobby	-	222	-	13
08 - Corridor 3	-	127	-	222
08 - Stair	-	128	-	49
08 - Lift Lobby	-	176	-	21
08 - Corridor 2	-	123	-	157
08 - Corridor 1	-	123	-	165
09 - King Room 07.01	-	223	-	55
09 - Twin Room 07.11	-	238	-	49
09 - Access King Room 07.17	-	221	-	64
09 - King Room 07.16	-	225	-	48
09 - Twin Room 07.15	-	221	-	55
09 - Twin Room 07.14	-	221	-	55
09 - King Room 07.12	-	223	-	53
09 - King Room 07.13	-	225	-	48
09 - King Room 07.02	-	223	-	55
09 - Twin Room 07.09	-	238	-	49
09 - Access King Room 07.03	-	221	-	64
09 - King Room 07.04	-	225	-	48
09 - Twin Room 07.05	-	221	-	55
09 - Twin Room 07.06	-	221	-	55
09 - King Room 07.08	-	223	-	53

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
09 - King Room 07.07	-	225	-	48
09 - WS Suite 07.10	-	208	-	124
09 - Stairs	-	126	-	53
09 - Resi Lift Lobby	-	152	-	29
09 - Riser Lobby	-	222	-	13
09 - Corridor 3	-	127	-	222
09 - Stair	-	128	-	49
09 - Lift Lobby	-	176	-	21
09 - Corridor 2	-	123	-	157
09 - Corridor 1	-	123	-	165
10 - King Room 07.01	-	223	-	55
10 - Twin Room 07.11	-	238	-	49
10 - Access King Room 07.17	-	221	-	64
10 - King Room 07.16	-	225	-	48
10 - Twin Room 07.15	-	221	-	55
10 - Twin Room 07.14	-	221	-	55
10 - King Room 07.12	-	223	-	53
10 - King Room 07.13	-	225	-	48
10 - King Room 07.02	-	223	-	55
10 - Twin Room 07.09	-	238	-	49
10 - Access King Room 07.03	-	221	-	64
10 - King Room 07.04	-	225	-	48
10 - Twin Room 07.05	-	221	-	55
10 - Twin Room 07.06	-	221	-	55
10 - King Room 07.08	-	223	-	53
10 - King Room 07.07	-	225	-	48
10 - WS Suite 07.10	-	208	-	124
10 - Stairs	-	126	-	53
10 - Resi Lift Lobby	-	152	-	29
10 - Riser Lobby	-	222	-	13
10 - Corridor 3	-	127	-	222
10 - Stair	-	128	-	49
10 - Lift Lobby	-	176	-	21
10 - Corridor 2	-	123	-	157
10 - Corridor 1	-	123	-	165
11 - King Room 07.01	-	223	-	55
11 - Twin Room 07.11	-	238	-	49
11 - Access King Room 07.17	-	221	-	64
11 - King Room 07.16	-	225	-	48
11 - Twin Room 07.15	-	221	-	55
11 - Twin Room 07.14	-	221	-	55
11 - King Room 07.12	-	223	-	53
11 - King Room 07.13	-	225	-	48

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
11 - King Room 07.02	-	223	-	55
11 - Twin Room 07.09	-	238	-	49
11 - Access King Room 07.03	-	221	-	64
11 - King Room 07.04	-	225	-	48
11 - Twin Room 07.05	-	221	-	55
11 - Twin Room 07.06	-	221	-	55
11 - King Room 07.08	-	223	-	53
11 - King Room 07.07	-	225	-	48
11 - WS Suite 07.10	-	208	-	124
11 - Stairs	-	126	-	53
11 - Resi Lift Lobby	-	152	-	29
11 - Riser Lobby	-	222	-	13
11 - Corridor 3	-	127	-	222
11 - Stair	-	128	-	49
11 - Lift Lobby	-	176	-	21
11 - Corridor 2	-	123	-	157
11 - Corridor 1	-	123	-	165
12 - King Room 07.01	-	223	-	55
12 - Twin Room 07.11	-	238	-	49
12 - Access King Room 07.17	-	221	-	64
12 - King Room 07.16	-	225	-	48
12 - Twin Room 07.15	-	221	-	55
12 - Twin Room 07.14	-	221	-	55
12 - King Room 07.12	-	223	-	53
12 - King Room 07.13	-	225	-	48
12 - King Room 07.02	-	223	-	55
12 - Twin Room 07.09	-	238	-	49
12 - Access King Room 07.03	-	221	-	64
12 - King Room 07.04	-	225	-	48
12 - Twin Room 07.05	-	221	-	55
12 - Twin Room 07.06	-	221	-	55
12 - King Room 07.08	-	223	-	53
12 - King Room 07.07	-	225	-	48
12 - WS Suite 07.10	-	208	-	124
12 - Stairs	-	126	-	53
12 - Resi Lift Lobby	-	152	-	29
12 - Riser Lobby	-	222	-	13
12 - Corridor 3	-	127	-	222
12 - Stair	-	128	-	49
12 - Lift Lobby	-	176	-	21
12 - Corridor 2	-	123	-	157
12 - Corridor 1	-	123	-	165
13 - King Room 07.01	-	223	-	55

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
13 - Twin Room 07.11	-	238	-	49
13 - Access King Room 07.17	-	221	-	64
13 - King Room 07.16	-	225	-	48
13 - Twin Room 07.15	-	221	-	55
13 - Twin Room 07.14	-	221	-	55
13 - King Room 07.12	-	223	-	53
13 - King Room 07.13	-	225	-	48
13 - King Room 07.02	-	223	-	55
13 - Twin Room 07.09	-	238	-	49
13 - Access King Room 07.03	-	221	-	64
13 - King Room 07.04	-	225	-	48
13 - Twin Room 07.05	-	221	-	55
13 - Twin Room 07.06	-	221	-	55
13 - King Room 07.08	-	223	-	53
13 - King Room 07.07	-	225	-	48
13 - WS Suite 07.10	-	208	-	124
13 - Stairs	-	126	-	53
13 - Resi Lift Lobby	-	152	-	29
13 - Riser Lobby	-	222	-	13
13 - Corridor 3	-	127	-	222
13 - Stair	-	128	-	49
13 - Lift Lobby	-	176	-	21
13 - Corridor 2	-	123	-	157
13 - Corridor 1	-	123	-	165
14 - King Room 07.01	-	223	-	55
14 - Twin Room 07.11	-	238	-	49
14 - Access King Room 07.17	-	221	-	64
14 - King Room 07.16	-	225	-	48
14 - Twin Room 07.15	-	221	-	55
14 - Twin Room 07.14	-	221	-	55
14 - King Room 07.12	-	223	-	53
14 - King Room 07.13	-	225	-	48
14 - King Room 07.02	-	223	-	55
14 - Twin Room 07.09	-	238	-	49
14 - Access King Room 07.03	-	221	-	64
14 - King Room 07.04	-	225	-	48
14 - Twin Room 07.05	-	221	-	55
14 - Twin Room 07.06	-	221	-	55
14 - King Room 07.08	-	223	-	53
14 - King Room 07.07	-	225	-	48
14 - WS Suite 07.10	-	208	-	124
14 - Stairs	-	126	-	53
14 - Resi Lift Lobby	-	152	-	29

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
14 - Riser Lobby	-	222	-	13
14 - Corridor 3	-	127	-	222
14 - Stair	-	128	-	49
14 - Lift Lobby	-	176	-	21
14 - Corridor 2	-	123	-	157
14 - Corridor 1	-	123	-	165
15 - King Room 15.01	-	223	-	55
15 - King Room 15.11	-	221	-	64
15 - King Room 15.11	-	225	-	48
15 - Twin Room 15.10	-	221	-	55
15 - Twin Room 15.09	-	221	-	55
15 - King Room 15.08	-	225	-	48
15 - King Room 15.02	-	223	-	55
15 - Access King Room 15.03	-	221	-	64
15 - Stairs	-	126	-	53
15 - Resi Lift Lobby	-	152	-	29
15 - Riser Lobby	-	222	-	13
15 - Stair	-	128	-	49
15 - Lift Lobby	-	176	-	21
15 - Corridor 2	-	123	-	157
15 - Corridor 1	-	123	-	165
15 - Corridor 3	-	126	-	206
15 - WOW Suite 15.06	-	205	-	168
15 - WOW Suite 15.07	-	205	-	168
15 - W Suite 15.05	-	207	-	102
15 - W Suite 15.04	-	207	-	103
16 - King Room 16.01	-	223	-	55
16 - Access King Room 16.14	-	221	-	64
16 - King Room 16.13	-	225	-	48
16 - Twin Room 16.12	-	221	-	55
16 - Twin Room 16.11	-	221	-	55
16 - King Room 16.10	-	225	-	48
16 - King Room 16.02	-	223	-	55
16 - Access King Room 16.03	-	221	-	64
16 - Stairs	-	126	-	53
16 - Resi Lift Lobby	-	152	-	29
16 - Riser Lobby	-	222	-	13
16 - Stair	-	128	-	49
16 - Lift Lobby	-	176	-	21
16 - Corridor 2	-	123	-	157
16 - Corridor 1	-	123	-	165
16 - W Suite 16.06	-	207	-	102
16 - Corridor 3	-	124	-	188

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
16 - King Room 16.07	-	223	-	53
16 - E WOW Suite 16.08	-	200	-	238
16 - King Room 16.09	-	223	-	53
15 - King Room 16.04	-	225	-	48
16 - King Room 16.05	-	221	-	55

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B2 - Staff Changing 10	N/A	N/A
B2 - Staff Changing 11	N/A	N/A
B2 - Data Room 01	N/A	N/A
B2 - IT Office 02	N/A	N/A
B2 - Room 1	N/A	N/A
B2 - Gym/Spa	N/A	N/A
B1 - Core 1	N/A	N/A
B1 Core 2	N/A	N/A
B1 - Core 3	N/A	N/A
B1 - Stairs 2	N/A	N/A
B1 - Changing 12	N/A	N/A
B1 - Stairs 1	N/A	N/A
02 - Open Plan Office	NO (-61.3%)	YES
03 - Open Plan Office	NO (-67.4%)	YES
04 - Open Plan Office	NO (-67.4%)	YES
05 - Open Plan Office	NO (-67.4%)	YES
00 - Entrance Lobby	NO (-77.4%)	YES
00 - Conference Facilities 01.06	NO (-51.7%)	YES
00 - Admin/BOH 01.18	N/A	N/A
00 - BOH 01.05	N/A	N/A
01 - Satff Offices 01.03	N/A	N/A
01 - Staff Canteen 01.02	N/A	N/A
01 - Open Plan Office 01.01	NO (-67.1%)	YES
06 - Hotel 06.01	NO (-77.8%)	YES
07 - King Room 07.01	NO (-62.6%)	YES
07 - Twin Room 07.11	NO (-56.3%)	YES
07 - Access King Room 07.17	NO (-62.6%)	YES
07 - King Room 07.16	NO (-62.4%)	YES
07 - Twin Room 07.15	NO (-62.3%)	YES
07 - Twin Room 07.14	NO (-62.5%)	YES
07 - King Room 07.12	NO (-62.6%)	YES
07 - King Room 07.13	NO (-61.6%)	YES
07 - King Room 07.02	NO (-67.2%)	YES
07 - Twin Room 07.09	NO (-59.2%)	YES
07 - Access King Room 07.03	NO (-70.2%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
07 - King Room 07.04	NO (-69.8%)	YES
07 - Twin Room 07.05	NO (-68.5%)	YES
07 - Twin Room 07.06	NO (-67.1%)	YES
07 - King Room 07.08	NO (-65.1%)	YES
07 - King Room 07.07	NO (-64.8%)	YES
07 - WS Suite 07.10	NO (-55%)	YES
08 - King Room 07.01	NO (-62.6%)	YES
08 - Twin Room 07.11	NO (-56.3%)	YES
08 - Access King Room 07.17	NO (-62.6%)	YES
08 - King Room 07.16	NO (-62.4%)	YES
08 - Twin Room 07.15	NO (-62.3%)	YES
08 - Twin Room 07.14	NO (-62.5%)	YES
08 - King Room 07.12	NO (-62.6%)	YES
08 - King Room 07.13	NO (-61.6%)	YES
08 - King Room 07.02	NO (-67.2%)	YES
08 - Twin Room 07.09	NO (-59.2%)	YES
08 - Access King Room 07.03	NO (-70.2%)	YES
08 - King Room 07.04	NO (-69.8%)	YES
08 - Twin Room 07.05	NO (-68.5%)	YES
08 - Twin Room 07.06	NO (-67.1%)	YES
08 - King Room 07.08	NO (-65.1%)	YES
08 - King Room 07.07	NO (-64.8%)	YES
08 - WS Suite 07.10	NO (-55%)	YES
09 - King Room 07.01	NO (-62.6%)	YES
09 - Twin Room 07.11	NO (-56.3%)	YES
09 - Access King Room 07.17	NO (-62.6%)	YES
09 - King Room 07.16	NO (-62.4%)	YES
09 - Twin Room 07.15	NO (-62.3%)	YES
09 - Twin Room 07.14	NO (-62.5%)	YES
09 - King Room 07.12	NO (-62.6%)	YES
09 - King Room 07.13	NO (-61.6%)	YES
09 - King Room 07.02	NO (-67.2%)	YES
09 - Twin Room 07.09	NO (-59.2%)	YES
09 - Access King Room 07.03	NO (-70.2%)	YES
09 - King Room 07.04	NO (-69.8%)	YES
09 - Twin Room 07.05	NO (-68.5%)	YES
09 - Twin Room 07.06	NO (-67.1%)	YES
09 - King Room 07.08	NO (-65.1%)	YES
09 - King Room 07.07	NO (-64.8%)	YES
09 - WS Suite 07.10	NO (-55%)	YES
10 - King Room 07.01	NO (-62.6%)	YES
10 - Twin Room 07.11	NO (-56.3%)	YES
10 - Access King Room 07.17	NO (-62.6%)	YES
10 - King Room 07.16	NO (-62.4%)	YES
10 - Twin Room 07.15	NO (-62.3%)	YES
10 - Twin Room 07.14	NO (-62.5%)	YES
10 - King Room 07.12	NO (-62.6%)	YES
10 - King Room 07.13	NO (-61.6%)	YES
10 - King Room 07.02	NO (-67.2%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
10 - Twin Room 07.09	NO (-59.2%)	YES
10 - Access King Room 07.03	NO (-70.2%)	YES
10 - King Room 07.04	NO (-69.8%)	YES
10 - Twin Room 07.05	NO (-68.5%)	YES
10 - Twin Room 07.06	NO (-67.1%)	YES
10 - King Room 07.08	NO (-65.1%)	YES
10 - King Room 07.07	NO (-64.8%)	YES
10 - WS Suite 07.10	NO (-55%)	YES
11 - King Room 07.01	NO (-62.6%)	YES
11 - Twin Room 07.11	NO (-56.3%)	YES
11 - Access King Room 07.17	NO (-62.6%)	YES
11 - King Room 07.16	NO (-62.4%)	YES
11 - Twin Room 07.15	NO (-62.3%)	YES
11 - Twin Room 07.14	NO (-62.5%)	YES
11 - King Room 07.12	NO (-62.6%)	YES
11 - King Room 07.13	NO (-61.6%)	YES
11 - King Room 07.02	NO (-67.2%)	YES
11 - Twin Room 07.09	NO (-59.2%)	YES
11 - Access King Room 07.03	NO (-70.2%)	YES
11 - King Room 07.04	NO (-69.8%)	YES
11 - Twin Room 07.05	NO (-68.5%)	YES
11 - Twin Room 07.06	NO (-67.1%)	YES
11 - King Room 07.08	NO (-65.1%)	YES
11 - King Room 07.07	NO (-64.8%)	YES
11 - WS Suite 07.10	NO (-55%)	YES
12 - King Room 07.01	NO (-62.6%)	YES
12 - Twin Room 07.11	NO (-56.3%)	YES
12 - Access King Room 07.17	NO (-62.6%)	YES
12 - King Room 07.16	NO (-62.4%)	YES
12 - Twin Room 07.15	NO (-62.3%)	YES
12 - Twin Room 07.14	NO (-62.5%)	YES
12 - King Room 07.12	NO (-62.6%)	YES
12 - King Room 07.13	NO (-61.6%)	YES
12 - King Room 07.02	NO (-67.2%)	YES
12 - Twin Room 07.09	NO (-59.2%)	YES
12 - Access King Room 07.03	NO (-70.2%)	YES
12 - King Room 07.04	NO (-69.8%)	YES
12 - Twin Room 07.05	NO (-68.5%)	YES
12 - Twin Room 07.06	NO (-67.1%)	YES
12 - King Room 07.08	NO (-65.1%)	YES
12 - King Room 07.07	NO (-64.8%)	YES
12 - WS Suite 07.10	NO (-55%)	YES
13 - King Room 07.01	NO (-62.6%)	YES
13 - Twin Room 07.11	NO (-56.3%)	YES
13 - Access King Room 07.17	NO (-62.6%)	YES
13 - King Room 07.16	NO (-62.4%)	YES
13 - Twin Room 07.15	NO (-62.3%)	YES
13 - Twin Room 07.14	NO (-62.5%)	YES
13 - King Room 07.12	NO (-62.6%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
13 - King Room 07.13	NO (-61.6%)	YES
13 - King Room 07.02	NO (-67.2%)	YES
13 - Twin Room 07.09	NO (-59.2%)	YES
13 - Access King Room 07.03	NO (-70.2%)	YES
13 - King Room 07.04	NO (-69.8%)	YES
13 - Twin Room 07.05	NO (-68.5%)	YES
13 - Twin Room 07.06	NO (-67.1%)	YES
13 - King Room 07.08	NO (-65.1%)	YES
13 - King Room 07.07	NO (-64.8%)	YES
13 - WS Suite 07.10	NO (-55%)	YES
14 - King Room 07.01	NO (-62.6%)	YES
14 - Twin Room 07.11	NO (-56.3%)	YES
14 - Access King Room 07.17	NO (-62.6%)	YES
14 - King Room 07.16	NO (-62.4%)	YES
14 - Twin Room 07.15	NO (-62.3%)	YES
14 - Twin Room 07.14	NO (-62.5%)	YES
14 - King Room 07.12	NO (-62.6%)	YES
14 - King Room 07.13	NO (-61.6%)	YES
14 - King Room 07.02	NO (-67.2%)	YES
14 - Twin Room 07.09	NO (-59.2%)	YES
14 - Access King Room 07.03	NO (-70.2%)	YES
14 - King Room 07.04	NO (-69.8%)	YES
14 - Twin Room 07.05	NO (-68.5%)	YES
14 - Twin Room 07.06	NO (-67.1%)	YES
14 - King Room 07.08	NO (-65.1%)	YES
14 - King Room 07.07	NO (-64.8%)	YES
14 - WS Suite 07.10	NO (-55%)	YES
15 - King Room 15.01	NO (-62.6%)	YES
15 - King Room 15.11	NO (-62.6%)	YES
15 - King Room 15.11	NO (-62.4%)	YES
15 - Twin Room 15.10	NO (-62.3%)	YES
15 - Twin Room 15.09	NO (-62.5%)	YES
15 - King Room 15.08	NO (-61.6%)	YES
15 - King Room 15.02	NO (-67.2%)	YES
15 - Access King Room 15.03	NO (-70.2%)	YES
15 - WOW Suite 15.06	NO (-60%)	YES
15 - WOW Suite 15.07	NO (-57.8%)	YES
15 - W Suite 15.05	NO (-66%)	YES
15 - W Suite 15.04	NO (-69.2%)	YES
16 - King Room 16.01	NO (-62.6%)	YES
16 - Access King Room 16.14	NO (-62.6%)	YES
16 - King Room 16.13	NO (-62.4%)	YES
16 - Twin Room 16.12	NO (-62.3%)	YES
16 - Twin Room 16.11	NO (-62.5%)	YES
16 - King Room 16.10	NO (-61.6%)	YES
16 - King Room 16.02	NO (-67.2%)	YES
16 - Access King Room 16.03	NO (-70.2%)	YES
16 - W Suite 16.06	NO (-66%)	YES
16 - King Room 16.07	NO (-65.1%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
16 - E WOW Suite 16.08	NO (-55.8%)	YES
16 - King Room 16.09	NO (-62.7%)	YES
15 - King Room 16.04	NO (-69.8%)	YES
16 - King Room 16.05	NO (-68.5%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	26183.4	26183.4
External area [m^2]	13873.1	15316.9
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	6847.49	8469.08
Average U-value [W/m^2K]	0.49	0.55
Alpha value* [%]	10.03	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
40	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
60	**C1 Hotels**
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	7.38	7.44
Cooling	1.95	3.05
Auxiliary	3.61	2.51
Lighting	7.66	11.91
Hot water	35.03	42.49
Equipment*	51.07	51.07
TOTAL**	**55.64**	**67.4**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	74.88	78.5
Primary energy* [kWh/m^2]	166.56	160.05
Total emissions [kg/m^2]	28.2	30

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	13.5	45.7	0.8	2.6	4.6	4.46	4.83	4.79	6.8
	Notional	9.6	84.8	1	6.2	2	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	3.6	0.8	0	1	0
	Notional	0	0	0	0	3.4	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	66.9	0	23.2	0	0.1	0.8	0	1	0
	Notional	63.5	0	20.5	0	0.2	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	77.1	5.2	4.8	0.3	4.3	4.46	4.83	4.79	6.8
	Notional	68	18.4	7.4	1.3	4.6	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	444.7	0	25.6	21.3	4.46	4.83	4.79	6.8
	Notional	0	260.3	0	19.1	15	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	39.1	96.6	2.4	5.6	0.7	4.46	4.83	4.79	6.8
	Notional	48.6	66.7	5.3	4.9	0.3	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	6.7	26.8	0.4	1.5	9.5	4.46	4.83	4.79	6.8
	Notional	4.8	41.5	0.5	3	4.2	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	886.5	0	51	0	4.46	4.83	4.79	6.8
	Notional	0	615.9	0	45.1	0	2.56	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.08	B1000005:Surf[3]
Floor	0.2	0.05	00000017:Surf[6]
Roof	0.15	0.15	B1000011:Surf[4]
Windows, roof windows, and rooflights	1.5	1	SP00001A:Surf[1]
Personnel doors	1.5	2.2	00000015:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5